
IFB NO. Y18-743-RM

ISSUED: February 20, 2018

INVITATION FOR BIDS

FOR

BITHLO VEHICLE MAINTENANCE BUILDING

**PART H
TECHNICAL SPECIFICATIONS**

**PART H
Volume II**

.....

100% Construction Documents
ARCHITECTURAL DESIGN COLLABORATIVE

**PROJECT
MANUAL**

FOR THE

Bithlo Vehicle Maintenance Building

PREPARED FOR

**Internal Operations Center II
400 East South Street, 5th Floor
Orlando, Florida 32801**

March 08, 2107

SECTION 00 0103
STATEMENT OF COMPLIANCE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. To the best of my knowledge the Plans and Specifications comply with the applicable minimum building codes and the applicable fire-safety standards as determined by the local authority in accordance with this Section and 633 Florida Statutes.
- B. Reference Article 101.4 Applicability, Paragraph 101.4.2 Building of the FBC.

PART 2 - PRODUCTS – Not Used

PART 3 - EXECUTION – Not Used

END OF SECTION 00 0103

SECTION 00 0104
NON-ASBESTOS CERTIFICATION

PART 1 - GENERAL

1.1 CERTIFICATION STATEMENT

- A. To the best of my knowledge these Contract Documents do not contain any asbestos containing materials intended for use in construction.

PART 2 - PRODUCTS – Not Used

PART 3 - EXECUTION – Not Used

END OF SECTION 00 0104

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SECTION 01005
ADMINISTRATIVE PROVISIONS

PART I GENERAL

1.1 WORK COVERED BY CONTRACT DOCUMENTS

- A. Work of this Contract comprises building, site work and related construction work to produce a complete and functional facility including but not limited to plumbing, mechanical, and electrical for the construction of Bithlo Vehicle Maintenance Building

1.2 CONTRACT METHOD

- A. Construct the work under a single lump sum contract (or as otherwise defined in bid documents).

1.3 COORDINATION

- A. Coordinate work of the various Sections of Specifications to assure efficient and orderly sequence of installation of construction elements, with provisions for accommodating items installed later.
- B. Verify characteristics of elements of interrelated operating equipment are compatible; coordinate work of various Sections having interdependent responsibilities for installing, connecting to and placing in service, such equipment. Differences shall be brought to the Owner's attention during bid process or remain the responsibility of the Contractor.
- C. Coordinate space requirements and installation of items, such as, but not limited to, mechanical and electrical work which are indicated diagrammatically or otherwise on drawings. Follow routing shown for pipes, ducts and conduits, as closely as practicable; make runs parallel with lines of building. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance and for repairs.
- D. In finished areas (except as otherwise shown), conceal pipes, ducts, and wiring in the construction. Coordinate locations of fixtures and outlets with finish elements.
- E. Execute cutting and patching to integrate elements of work, uncover ill timed, defective and nonconforming work, provide openings for penetrations of existing surfaces and provide samples as specified in individual sections for testing. Seal penetrations of existing surfaces and provide samples as specified in individual sections for testing. Seal penetrations through floors, walls and ceilings, and fire safe where necessary as part of the lump sum price.

1.4 FIELD ENGINEERING SURVEYING

- A. Provide field engineering surveying services; establish grades, lines and levels, by use of engineering survey practices recognized as standard by the survey industry. Said work shall be required to be provided by a Professional Land Surveyor, registered as such in the State of Florida.
- B. Control datum for survey is that shown on Grading and Drainage Plan. Locate and

protect control and reference points, per requirements stated in the GENERAL CONDITIONS.

1.5 REFERENCE STANDARDS

- A. For products specified by association or trade standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.
- B. The date of the standard is that in effect when a specified date is specified.

1.6 SUBMITTALS

- A. Obtain copies of referenced standards listed in individual specification sections. Maintain copy at job site during progress of the specific work.

END OF SECTION 01005

SECTION 01010
SUMMARY OF WORK

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 PROJECT DESCRIPTION

- A. Performance of all tasks specified in the contract documents shall be the responsibility of the contractor unless specified otherwise.

1.03 BUILDING/SITE SECURITY

- A. The construction site, to the limits indicated on the site plan, shall be secured by means of a construction fence, located around the entire perimeter of the construction site. This construction fence shall be required to be secure from unwarranted entry at the end of each day.

1.04 CONTRACTOR USE OF PREMISES

- A. General: Limited use of the premises to construction activities in areas indicated within the limit of the premises. The Contractor may use any portion of the site for storage or work areas or any legal purpose.
 - 1. Confine operations to areas within Contract limits indicated on the Drawings. Portions of the site beyond areas in which construction operations are indicated are not to be disturbed.
 - 2. Keep driveways and entrances serving the premises clear and available to the Owner and the Owners' employees at all times. Do not use these areas for parking or storage of materials. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on site.
 - 2. Burial of Waste Materials: Do not dispose of organic and hazardous material on site, either by burial or by burning.
 - 3. Comply with Owner's requirements for ingress and egress procedures, prohibitions against firearms, procedures for transportation of workers, safety and fire prevention requirements, and all applicable pollution control requirements. Refer to the following reference documents:
 - a. Orange County Safety and Health Manual
 - b. Orange County Policy Manual (pg. 96 regarding firearms)
 - 4. Require all employees and subcontractors to wear no-objectionable clothing; prohibit revealing clothing and articles of clothing with offensive writing displayed. Remove from premises all personnel until such clothing is changed.

5. All personnel shall abide by the Orange County Tobacco Free policy while on any Orange County property. Policy applies to buildings, parking lots, parks, break areas, and work sites. Tobacco products are defined as cigars, cigarettes, pipes, e-cigs, chewing tobacco and snuff. Failure to abide by the policy may result in civil penalties levied under Chapter 386, Florida Statutes and Contract enforcement remedies.

1.05 DISTRIBUTION OF RELATED DOCUMENTS

- A. The Contractor is solely responsible for the distribution of ALL related documents/drawings to ALL appropriate vendors/subcontractors to ensure proper coordination of all aspects of the project and its related parts during bidding and construction.

1.06 CONSTRUCTION BULLETIN BOARD

- A. The Contractor shall erect and maintain a weather protected bulletin board of sufficient size to display all permits, notices and other documents required to be posted for the Project. Said bulletin board shall be located per Owner's direction.

1.07 SECURITY AND IDENTIFICATION

- A. The building (construction area) shall be secured from unwanted entry at the end of each work day.
- B. All costs for background investigations will be the Contractor's responsibility. The County shall have the right to request any additional investigative background information including, but not limited to, employment records, Right-to Know records, E-verify system records (If the contractor uses this service as a means to determine employee eligibility), training records, payroll records, position for which hired including site location of any personnel assigned to perform the services. Furnish, in writing, all such information to the extent allowed by law, prior to commencement of services. The County reserves the right to conduct its own investigation of any employee or subcontractor of the Contractor.
- C. Background Checks for the Contractor's staff must be approved by Orange County's security team prior to working in any County facility. Obtain necessary forms for background checks for work at Orange County. All Contractor's staff background checks will be sent to the Orange County project Manager for approval.
- D. For security purposes and to maintain privacy, please submit a FDLE Background Checks via email. The subject line of the email must contain the following ***EXEMPT***
- E. Orange County will inform the Contractor of their Background Check results. Upon Background Check approval, the contractor's staff shall arrange an appointment with the Orange County staff to obtain an Orange County ID Badge. An Affidavit of Identity form (Issued by Contractor) and a State of Florida ID or Driver's License will be required.
- F. Contractor's employees will not be allowed in Orange county facilities without com-

pleted and approved background investigations.

1.08 BUILDING/SITE SECURITY REQUIREMENTS

- A. Provide security for each and every day that work is being performed on Site. The security firm that will be used is:
G4S Security Systems (USA), Inc.
Contact: Jose Troche, MBA
Phone: 407 207 3221
Jose.troche@usa.g4s.com

1.09 OWNER OCCUPANCY

- A. The Owner will occupy the building and areas next to the Work area. Normal hours are 7:00 AM to 5:00 PM Monday thru Friday. Coordinate with the Owner's representative for Work areas that can be performed on during normal work hours. Work can be performed after hours provided the area where Work is done is fully operational and back in original condition prior to beginning the next business day. Such placing of equipment and partial occupancy shall not constitute acceptance of the total Work.
1. A certificate of Substantial Completion will be executed for each specific portion of the Work to be occupied prior to Owner occupancy
 2. Obtain a Certificate of Occupancy from the local building officials prior to Owner occupancy.
 3. Prior to partial occupancy, mechanical and electrical systems shall be fully operational. Required inspections and tests shall have been successfully completed. Upon occupancy, the Owner will provide operation and maintenance of mechanical and electrical systems in occupied portions of the building.

PART 2 PRODUCTS

2.01 ASBESTOS FREE MATERIAL

- A. Contractor shall provide a written and notarized statement on company letterhead(s) to certify and warrant that ONLY ASBESTOS FREE MATERIALS AND PRODUCTS were provided as required by the Architect in Section 01400, QUALITY CONTROL. Such statement shall be submitted with the final payment request. Final payment shall not be made until such statement is submitted. Contractor agrees that if materials containing asbestos are subsequently discovered at any future time to have been included in the construction, the Contractor shall be liable for all costs related to the redesign or modification of the construction of the project so that materials containing asbestos are removed from the facility. If construction has begun or has been completed pursuant to a design that includes asbestos containing materials, the Contractor shall also be liable for all costs related to the abatement of such asbestos.

PART 3 EXECUTION (Not applicable).

END OF SECTION 01010

SECTION 01027
APPLICATION FOR PAYMENT

PART I GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. This Section specifies administrative and procedural requirements governing the Contractor's Applications for Payment.
- B. The Contractor's Construction Schedule and Submittal Schedule are included in Section 01300 – SUBMITTALS.

1.03 SCHEDULE OF VALUES

- A. Coordinate preparation of the Schedule of Values with preparation of Contractor's Construction Schedule.
 - 1. Submit the Schedule of Values to the Owner at the earliest feasible date, but in no case later than Preconstruction Meeting. Refer to Section 01200.
 - 2. Sub-Schedules: Where the Work is separated into phases that require separately phased payments, provide sub-schedules showing values correlated with each phase of payment.
- B. Format and Content: Use the Project Manual Table of Contents as a guide to establish the format for the Schedule of Values.
 - 1. Identification: Include the following project identification on the Schedule of Values:
 - a. Project name and location.
 - b. Name of the Architect
 - c. Project Number
 - d. Contractor's name and address
 - e. Date of submittal
 - 2. Arrange the Schedule of Values in a tabular form with separate columns to indicate the following for each item listed:
 - a. Generic name
 - b. Related Specification Section
 - c. Change Orders (numbers) that have affected value
 - d. Dollar Value
 - e. Percentage of Contract Sum to the nearest one-hundredth percent, adjusted to total 100 percent

3. Provide a breakdown of the Contract Sum in sufficient detail to facilitate continued evaluation of Applications for Payment and progress reports. Break principal subcontract amounts down into several line items:
 - a. A value will be given for at least every major specification section (subsections can logically be grouped together).
 - b. A single material subcontractor (i.e. sod, window blinds) will not be required to be broken down into labor and material unless it is anticipated the materials will be stored and invoiced prior to installation.
 - c. All multiple item subcontracts or work items (i.e. concrete, roofing, painting, mechanical, electrical items, etc.) will be shown broken down at least in labor and material (all taxes, burden and overhead and profit included).
 - d. Mobilization (move-on, bond, insurance, temporary office and sanitary service installation) shall not exceed 2 1/2% of contract price.
 - e. For multi-story work all items broken down per floor.
 - f. Concrete broken down at least into foundation slab on grade, columns, beams and suspended slabs.
 - g. Masonry divided into C.M.U. brick, stem walls, exterior walls, interior walls and elevator shaft.
 - h. Plumbing broken down at least into underslab rough-in, vents and stacks supply piping, equipment items (each listed separately), fixtures and trim.
 - i. HVAC: Typically shown per specification section, labor and material, per floor.
 - j. Electrical: same as HVAC.
 - k. Fire protection broken down at least into underground, rough-in and trim. All per building and labor and material.
 - l. Logical grouping of specification subsections is permitted.
4. Round amounts off the nearest whole dollar, the total shall equal the Contract Sum.
5. For each part of the Work where an Application for Payment may include materials or equipment, purchased or fabricated and stored, but not yet installed, provide separate line items on the Schedule of Values for initial cost of the materials, for each subsequent stage of completion, and for total installed value of that part of the Work.
6. Margins of Cost: Show line items for indirect costs, and margins on actual costs, only to the extent that such items will be listed individually in Applications for Payment. Each item in the Schedule of Values and Applications for Payment shall be complete including its total cost and proportionate share of general overhead and profit margin.
 - a. At the Contractors' option, temporary facilities and other major cost items that are not direct cost of actual work-in-place may be shown as separate line items in the Schedule of Values or distributed as general overhead expense.

7. Schedule Updating: Update and resubmit the Schedule of Values when Change Orders or Construction Change Directives result in a change in the contract sum.

1.04 APPLICATIONS FOR PAYMENT

- A. Each Application for Payment shall be consistent with previous applications and payments as reviewed by the Owner representative and paid for by the Owner.
 1. The initial Application for Payment, the Application for Payment at time of Substantial Completion, and the Final Application for Payment involve additional requirements.
- B. Payment Application Times: The period of construction work covered by each Application of Payment is the period indicated in the Agreement.
- C. Payment Application Forms: Use the County's most updated form as the form for Application for Payment. Form given at the Preconstruction Conference.
- D. Application Preparation: Complete every entry on the form, including notarization and execution by person authorized to sign legal documents on behalf of the Owner. Incomplete applications will be returned without action.
 1. Entries shall match data on the Schedule of Values and Contractors' Construction Schedule. Use updated schedules if revisions have been made.
 2. Include amounts of Change Orders and Construction Change Directives issued prior to the last day of the construction period covered by the application.
- E. Transmittal: Submit five (5) original executed copies of each Application for Payment to the Project Manager by means ensuring receipt within 24 hours; one copy shall be complete, including waivers of lien and similar attachments, when required.
 1. Transmit each copy with a transmittal form listing attachments, and recording appropriate information related to the application in a manner acceptable to the Project Manager.
- F. Payment will be processed once a month. Payment for item will be based on percentage completed as determined and approved by the County Project Manager or invoice for stored materials. Retainage (10%) will be held for all applications.
- G. Application for Payment at Substantial Completion: Following issuance of the Certificate of Substantial Completion, submit an Application for Payment; this application shall reflect any Certificates of Partial Substantial Completion issued previously for Owner occupancy of designated portions of the Work. Application shall also include all items listed in Part H. above.
- H. Final Payment Application: Administrative actions and submittals, which must

precede or coincide with submittal of the final payment. Application for Payment includes the following:

1. Completion of Project Close-Out requirements
2. Completion of items specified for completion after Substantial Completion (Punch List)
3. Contractor's release of lien (on Owner's form)
4. Subcontractor and material supplier release of lien (If applicable)
5. Consent of Surety
6. Power of attorney
7. Asbestos-free letter

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION (Not Applicable)

END OF SECTION 01027

SECTION 01035
MODIFICATION PROCEDURES

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. This section specifies administrative and procedural requirements for handling and processing Contract modifications.

1.03 MINOR CHANGES IN THE WORK

- A. Supplemental instructions authorizing minor changes in the work, not involving an adjustment to the Contract Sum or Contract Time, will be issued by the Project Manager.

1.04 CHANGE ORDER PROPOSAL REQUESTS

- A. Owner-Initiated Proposal Requests: Proposed changes in the work that will require adjustment to the Contract Sum or Contract Time will be issued by the Project Manager, with a detailed description of the proposed change and supplemental or revised Drawings and Specifications, if necessary.
 - 1. Proposal requests issued by the Project Manager are for information only. Do not consider them instruction either to stop work in progress, or to execute the proposed change.
 - 2. Unless otherwise indicated in the proposal request, within 7 days of receipt of the proposal request, submit to the Project Manager from the Owner's review, an estimate of cost necessary to execute the proposed change.
 - a. Include a list of quantities of products to be purchased and unit costs, along with the total amount of purchases to be made. Where requested, furnish survey data to substantiate quantities.
 - b. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
 - c. Include a statement indicating the effect the proposed change in the work will have on the Contract Time.
 - d. Contractor and subcontractors will provide a complete detailed labor and material breakdown to justify change order request amount.
- B. Contractor-Initiated Change Order Proposal Requests: When latent or other unforeseen conditions in mutual accord with the Owner Representative's findings require modifications to the Contract, the Contractor may propose changes by submitting a request for a change to the Architect.

1. Include a statement outlining the reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and Contract Time.
2. Include a list of quantities of products to be purchased and unit costs along with the total amount of purchases to be made. Where requested, furnish survey data to substantiate quantities.
3. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
4. Comply with requirements in Section 01631 – Product Substitutions- if the proposed change in the work requires that substitution of one product or system for a product or system not specified.
5. Contractor and subcontractors will provide a complete detailed labor and material breakdown to justify change order request amounts.

1.05 CONSTRUCTION CHANGE DIRECTIVE

- A. Construction Change Directive: When the Owner and Contractor are not in total agreement on the terms of a Change Order Proposal Request, the Project Manager may issue a Construction Change Directive instructing the Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.
 1. The Construction Change Directive will contain a complete description of the change in the Work and designate the method to be followed to determine change in the Contract Sum or Contract Time.
- B. Documentation: Maintain detailed records on a time and material basis of work required by the Construction Change Directive.
 1. After completion of the change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

1.07 CHANGE ORDER PROCEDURES

- A. Upon the Owner's approval of a Change Order Proposal Request, the Project Manager will issue a Change Order for signatures of the Owner and Contractor on County's Change Order form, as provided in the Conditions of the Contract.

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION (Not Applicable)

END OF SECTION 01035

SECTION 01040
PROJECT COORDINATION

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. This Section specifies administrative and supervisory requirements necessary for project coordination including, but not necessarily limited to:
1. Coordination
 2. Administrative and supervisory personnel
 3. General installation provisions
 4. Cleaning and protection
- B. Progress meetings, coordination meetings And Pre-installation conferences are included in Section 01200 'Project Meetings'.
- C. Requirements for the Contractor's Construction Schedule are included in Section 01300 'Submittals'.

1.03 COORDINATION

- A. Coordination: Coordinate construction activities included under various Sections of these Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations included under different Sections of the Specification that are dependent upon each other for proper installation, connection, and operation.
1. Where installation of one part of the Work is dependent on installation of other components, either before or after its own installation, schedule construction activities in the sequence required to obtain the best results.
 2. Where availability of space is limited, coordinate installation of different components to assure maximum accessibility for required maintenance, service and repair.
 3. Make adequate provisions to accommodate items scheduled for later installation.
- B. Where necessary, prepare memoranda for distribution to each party involved outlining special procedures required for coordination. Include such items as required: notices, reports, and attendance at meetings.
1. Prepare similar memoranda for the Owner and separate Contractors where coordination of their Work is required.

- C. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities to avoid conflicts and ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:
 - 1. Preparation of Schedules
 - 2. Installation and removal of temporary facilities
 - 3. Delivery and processing of submittals
 - 4. Progress meetings
 - 5. Project close-out activities
- D. Conservation: Coordinate construction activities to ensure that operations are carried out with consideration given to conservation of energy, water, and materials.
 - 1. Salvage materials and equipment (if any) involved in performance of, but not actually incorporated in, the Work.
- E. Lack of coordination as specified in this and other sections of the contract documents are in grounds for assessment of back charges and/or termination in order to remediate the situation.

1.04 SUBMITTALS

- A. Coordination Drawings: Prepare and submit coordination Drawings where close and careful coordination is required for installation of products and materials fabricated off-site by separate entities, and where limited space availability necessitates maximum utilization of space for efficient installation of different components.
 - 1. Show the interrelationship of components shown on separate Shop Drawings.
 - 2. Indicate required installation sequences.
 - 3. Comply with requirements contained in Section Submittals.
 - 4. Refer to Facility Services documents for specific coordination Drawing requirements for mechanical and electrical installations.
- B. Staff Names: At the Preconstruction Conference submit a list of the Contractor's principal staff assignments, including the Superintendent and other personnel in attendance at the site; identify individuals, their duties and responsibilities; list their addresses and telephone numbers.
 - 1. Post copies of the list in the project meeting room, the temporary field office, and each temporary telephone.

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION

PROJECT COORDINATION

01040-2

3.01 GENERAL INSTALLATION PROVISIONS

- A. Inspection of Conditions: Require the Installer of each major component to inspect both the substrate and conditions under which work is to be performed. Do not proceed until unsatisfactory conditions have been corrected in an acceptable manner.
- B. Manufacturer's Instructions: Comply with manufacturer's installation instructions and recommendations, to the extent that those instructions and recommendations are more explicit or stringent than requirements contained in Contract Documents.
- C. Inspect materials or equipment immediately upon delivery and again prior to installation. Reject damaged and defective items.
- D. Provide attachment and connection devices and methods necessary for securing work. Secure work true to line and level. Allow for expansion and building movement.
- E. Visual Effects: Provide uniform joint widths in exposed work. Arrange joints in exposed work to obtain the best visual effect. Refer questionable choices to Project Manager for final decision.
- F. Recheck measurements and dimensions, before starting each installation.
- G. Install each component during weather conditions and Project status that will ensure the best possible results. Isolate each part of the completed construction from incompatible material as necessary to prevent deterioration.
- H. Coordinate temporary enclosures with required inspections and tests, to minimize the necessity of uncovering completed construction for that purpose.
- I. Mounting Heights: Where mounting heights are not indicated, install individual components at standard mounting heights recognized within the industry for the particular application indicated. Refer questionable mounting height decisions to the Architect/Project Manager for final decision.

3.02 CLEANING AND PROTECTION

- A. During handling and installation, clean and protect construction in progress and adjoining materials in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.
- B. Clean and maintain completed construction as directed by the Project Manager and as frequently as necessary to ensure its integrity and safety through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.
- C. Limiting Exposures: Supervise construction activities to ensure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period. Where the

applicable, such exposures include, but are not limited to, the following:

1. Excessive static or dynamic loading
2. Excessively high or low temperatures
3. Excessively high or low humidity
4. Air contamination or pollution
5. Water
6. Solvents
7. Chemicals
8. Soiling, staining and corrosion
9. Rodent and insect infestation
10. Combustion
11. Destructive testing
12. Misalignment
13. Excessive weathering
14. Unprotected storage
15. Improper shipping or handling
16. Theft
17. Vandalism

END OF SECTION 01040

SECTION 01095
REFERENCE STANDARDS AND DEFINITIONS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 DEFINITIONS

- A. General: Basic Contract definitions are included in the Conditions of the Contract.
- B. Indicated: The term *indicated* refers to graphic representations, notes or schedules on the Drawings, or other Paragraphs or Schedules in the Specifications, and similar requirements in the Contract Documents. Where terms such as shown, noted, scheduled and specified are used, it is to help the reader locate the reference; no limitation on location is intended.
- C. Directed: Terms such as directed, requested, authorized, selected, accepted, required, and permitted mean directed by the Project Manager, requested by the Architect/Project Manager and similar phrases.
- D. Approved: This term approved means accepted, where used in conjunction with the Architect's action on the Contractor's submittals, applications, and requests, is limited to the Architect's duties and responsibilities as stated in the Conditions of the Contract.
- E. Regulations: The term Regulations includes laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, as well as rules, conventions, and agreements within the construction industry that control performance of the Work.
- F. Furnish: The term furnish is used to mean supply and deliver to the Project site, ready for unloading, unpacking, assembly, installation, and similar operations.
- G. Install: The term install is used to describe operations at project site including the actual unloading, unpacking, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.
- H. Provide: The term provide means to furnish and install, complete and ready for the intended use.
- I. Installer: An Installer is the Contractor or an entity engaged by the Contractor, either as an employee, subcontractor, or contractor of lower tier for performance of a particular construction activity, including installation, erection, application, and similar operations. Installers are required to be experienced in the operations they are engaged to perform.
 - 1. The term experienced, when used with the term Installer, means having a minimum of five previous projects similar in size and scope to this Project,

being familiar with the special requirements indicated, and having complied with requirements of the authority having jurisdiction.

2. Trades: Use of titles such as carpentry is not intended to imply that certain construction activities must be performed by accredited or unionized individuals of a corresponding generic name, such as carpenter. It also does not imply that requirements specified apply exclusively to trades persons of the corresponding generic name.
- J. Project Site is the space available to the Contractor for performance of construction activities, either exclusively or in conjunction with others performing other work as part of the Project. The extent of the Project Site is shown on the Drawings and may or may not be identical with the description of the land on which the Project is to be built.
- K. Testing Laboratories: A testing laboratory is an independent entity engaged to perform specific inspections or tests, either at the Project sites or elsewhere, and to report on and, if required, to interpret results of those inspections or tests.
- L. Florida Building Code (FBC): Where the term or acronym is used it will mean the current edition of the Florida Building Code with all applicable revisions adopted by the authorities having jurisdictions at the location of the Project.

1.03 SPECIFICATION FORMAT AND CONTENT EXPLANATION

- A. Specification Format: These Specifications are organized into Divisions and Sections based on the Construction Specifications Institute's 16 Division format and MASTER FORMAT numbering system.
- B. Specification Content: This Specification uses certain conventions in the use of language and the intended meaning of certain terms, words, and phrases when used in particular situations or circumstances. These conventions are explained as follows:
 1. Abbreviated Language: Language used in Specifications and other Contract Documents is the abbreviated type. Words and meaning shall be interpreted as appropriate. Words that are implied, but not stated shall be interpolated as the sense required. Singular words will be interpreted as plural and plural words interpreted as singular where applicable and the context of the Contract Documents so indicates.
 2. Imperative and streamlined language is used generally in the Specifications. Requirements expressed in the imperative mood are to be performed by the Contractor. At certain locations in the text, for clarity, subjective language is used to describe responsibilities that must be fulfilled indirectly by the Contractor, or by others when so noted.
 - a. The words, shall be shall be included by inference wherever a colon (:) is used within a sentence or phrase.

1.04 INDUSTRY STANDARDS

- A. Applicability of Standards: Except where the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copies directly into the Contract Documents to the extend reference. Such standards are made part of the Contract Documents by reference.
- B. Publication Dates: Comply with the standard in effect as of the date of the Contract Documents.
- C. Conflicting Requirements: Where compliances with two or more standards are specified, and the standards may establish different or conflicting requirements for minimum quantities or quality levels. Refer requirements that are different, but apparently equal, and uncertainties to the Architect for a decision before proceeding.
 - 1. Minimum Quantity or Quality Levels: The quantity of 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. In complying with these requirements, indicated numeric values are minimum or maximum, as appropriate for the context of the requirements. Refer uncertainties to the Architect/Owner for a decision before proceeding.
- D. Copies of Standards: Each entity engaged in construction on the Project is required to be familiar with industry standards applicable to that entity's construction activity. Copies of applicable standards are not bound with the Contract Documents.
 - 1. Where copies of standards are needed for performance of a required construction activity. The Contractor shall obtain copies directly from the publication source or any other authorized source.
- E. Abbreviations and Names: Trade association names and titles of general standards are frequently abbreviated. Where such acronyms or abbreviations are used in the Specifications or other Contract Documents, they mean the recognized name of the trade association, standards generating organization, authority having jurisdiction, or other entity applicable to the context of the text provision. See Trade Reference List at the end of this Section refer to the Encyclopedia of Associations, published by Gale Research Co., available in most libraries.

1.05 SUBMITTALS

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

PART 2 PRODUCTS

(Not Applicable)

PART 3 EXECUTION

(Not Applicable)

END OF SECTION 01095

SECTION 01200
PROJECT MEETINGS

PART 1 GENERAL

1.01 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.

1.02 SUMMARY

- A. This Section specifies administrative and procedural requirements for project meetings including but not limited to:
 - 1. Pre-Construction Conference
 - 2. Pre-Installation Conference
 - 3. Coordination Meetings
 - 4. Progress Meetings
- B. Construction schedules are specified in Section 01300 Submittals.

1.03 PRE-CONSTRUCTION CONFERENCE

- A. Schedule a pre-construction conference and organizational meeting at the project site or other convenient location no later than 20 days after execution of the agreement and prior to commencement of construction activities. Conduct the meeting to review responsibilities and personnel assignments.
- B. Attendees: The OWNER'S Representative, Architect, the Contractor and its superintendent, major subcontractors, manufacturers, suppliers and other concerned parties shall each be represented at the conference by persons familiar with and authorized to conclude matters relating to the work.
- C. Agenda: Discuss items of significance that could affect progress including such topics as:
 - 1. Tentative construction schedule
 - 2. Critical Work sequencing and/coordinating
 - 3. Designation of responsible personnel
 - 4. Procedures for processing field decisions and Change Orders
 - 5. Procedures for processing Applications for Payment
 - 6. Distribution of Contract Documents
 - 7. Submittal of Shop Drawings, Product Data and Samples
 - 8. Preparation of record documents
 - 9. Use of the Premises
 - 10. Office, Work and storage areas
 - 11. Equipment deliveries and priorities
 - 12. Safety procedures
 - 13. First aid

14. Security
15. Housekeeping
16. Working hours

D. Contractor must submit at the time of the meeting at least the following items:

1. Schedule of Values
2. Listing of key personnel including project superintendent and subcontractors with their addresses, telephone numbers, and emergency telephone numbers.
3. Preliminary Construction Schedule
4. Submittal Schedule

1.04 PRE-INSTALLATION CONFERENCE

A. Conduct a Pre-installation conference at the site before each construction activity that requires coordination with other construction. The Installer and representatives of manufacturers and fabricators involved in or affected by the installation, and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise at least 48 hours in advance the Project Manager of scheduled meeting dates.

1. Review the progress of other construction activities and preparations for the particular activity under consideration at each pre-installation conference, including requirements for:
 - a. Contract Documents
 - b. Options
 - c. Related Change Orders
 - d. Purchases
 - e. Deliveries
 - f. Shop Drawings, Product Data and Quality Control Samples
 - g. Possible conflicts
 - h. Compatibility problems
 - i. Time schedules
 - j. Weather limitations
 - k. Manufacturer's recommendations
 - l. Comparability of materials
 - m. Acceptability of substrates
 - n. Temporary facilities
 - o. Space and access limitations
 - p. Governing regulations
 - q. Safety
 - r. Inspection and testing requirements
 - s. Required performance results
 - t. Recording requirements
 - u. Protection
2. Record significant discussions, agreements, and disagreements of each conference along with an approved schedule. Distribute the record of the meeting to everyone concerned promptly including the Owner and Architect.

3. Do not proceed if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of Work and reconvene the conference at the earliest feasible date.

1.05 COORDINATION MEETINGS

- A. Conduct project coordination meeting at weekly intervals on day and time as established by the Project Manager or more frequently, if necessary convenient for all parties involved. Project coordination meetings are in addition to specific meetings held for other purposes, such as regular progress meetings and special pre-installation meetings.
- B. Request representation at each meeting by every party currently involved in coordination or planning for the construction activities involved, to include subcontractors and representatives.
- C. Contractor shall record meeting results and distribute copies to everyone in attendance and to others affected by decisions or actions resulting from each meeting.

1.06 PROGRESS MEETINGS

- A. Conduct progress meetings at the Project site at bimonthly intervals or more frequently if necessary as directed by the Project Manager. Notify the Owner at least 48 hours in advance of scheduled meeting time and dates. Coordinate dates of meetings with preparation of the payment request.
- B. Attendees: In addition to representatives of the Owner and Architect, each subcontractor, supplier or other entity concerned with current progress of involved in planning, coordination or performance of future activities with the project and authorized to conclude matters relating to progress.
- C. Agenda: Review and correct or approve minutes of the previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to the current status of the Project.
 1. Contractor's Construction Schedule: Review progress since the last meeting. Determine where each activity is in relation to the Contractor's Construction Schedule, whether on time, ahead, or behind schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
 2. Review the present and future needs of each entity present, including such items as:
 - a. Interface requirements
 - b. Time
 - c. Sequences

- d. Deliveries
- e. Off-site fabrication problems
- f. Access
- g. Site utilization
- h. Temporary facilities and services
- i. Hours of work
- j. Hazards and risks
- k. Housekeeping
- l. Quality and work standards
- m. Change Orders
- n. Documentation of information for payment requests.

D. Reporting: No later than 3 days after each progress meeting date, distribute copies of minutes of the meeting to each party present and to other parties who should have been present. Include a brief summary, in narrative form, or progress since the previous meeting and report.

PART 2 PRODUCTS

(Not Applicable)

PART 3 EXECUTION

(Not Applicable)

END OF SECTION 01200

SECTION 01300
SUBMITTALS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. This Section specifies administrative and procedural requirements for submittals required for performance of the Work, including:

1. Contractor's Construction Schedule
2. Submittal Schedule
3. Daily Construction Reports
4. Shop Drawings
5. Product Data
6. Samples

- B. Administrative Submittals: Refer to other Division-1 Sections and other Contract Documents for requirements for administrative submittals. Such submittals include, but are not limited to:

1. Permits
2. Applications for Payment
3. Performance and Payment Bonds
4. Insurance Certificates
5. List of Subcontractors with start and finish dates (update as necessary)
6. Schedule of Values
7. Construction Schedule

- C. The Schedule of Values submittal is included in Section 01027 Applications for Payment.

- D. Inspection and test reports are included in Section 01400 Quality Control Services.

1.03 SUBMITTAL PROCEDURES

- A. Review, stamp and approve each submittal prior to transmitting to Architect. Without such stamp and signature, submittal will be returned NOT REVIEWED.

- B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities. Transmit each submittal sufficiently in advance of performance of related construction activities to avoid delay.

1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals and related activities that require sequential activity.

2. Coordinate transmittal of different types of submittals for related elements of the Work so processing will not be delayed by the need to review submittals concurrently for coordination.
 - a. The Project Manager reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.
 3. Processing: Allow sufficient review time so that installation will not be delayed as a result of the time required to process submittals, including time for resubmittals.
 - a. Allow two weeks for initial review. Allow additional time if processing must be delayed to permit coordination with subsequent submittals. The Project Manager will promptly advise the Contractor when a submittal being processed must be delayed for coordination.
 - b. If an intermediate submittal is necessary, process the same as the initial submittal.
 - c. Allow two weeks for reprocessing each submittal.
 - d. No extension of Contract Time will be authorized because of failure to transmit submittals to the Architect sufficiently in advance of the Work to permit processing.
- B. Electronic Submittal Administrative Requirements
1. Identify and incorporate information in each electronic submittal file as follows:
 - a. Assemble complete submittal package into a single indexed and bookmarked file with links enabling navigation to each item.
 - b. Scanned using 300 dpi resolution
 - c. Name file with submittal number identifier described in Part 1 Article – Submittal Procedures
 - d. Provide means for insertion to permanently record Contractor's review and approval markings and action taken by all reviewers.
 - e. Samples will require a physical delivery with transmittal. Sample approval may be electronic, depending on submittal requirements of that section.
 2. Post electronic submittals as PDF electronic files directly to designated FTP site specifically established for Project. Notify Architect via email when shop drawing files have been posted.
 - a. Architect will return annotated file. Annotate and retain one copy of file as an electronic Project record document file.
 - b. Provide electronic submittals for:
 - 1) Product Data
 - 2) Shop Drawings
 - 3) Project Schedule
 - 4) Sustainable Construction Program Submittals
 - 5) Delegated Design Services
 - c. Required Number of Submittals:

- 1) Submit one CD with Shop Drawings
 - 2) Scan all pages of submittal to .pdf format and submit on a CD
 - 3) Distribution: 1 CD will returned for printing and distribution
3. 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
- D. Contractor shall be responsible for cost of re-review of rejected submittals. Costs for re-review shall be reimbursed to the County by deducting the cost from the Contractors monthly progress payments. Costs to be determined by applying the consultant's standard billing rates, plus 10% handling by the County.
- E. Substitution request to specified products will be made within 30 days of Notice to Proceed. After the 30 day period, no requests for substitutions from the Contractor will be considered.
1. Substitution submitted within the first 30 days will have product data from specified and requested substitute submitted together and demonstrate better quality, cost savings if of equal quality, or show benefit to the County for excepting the substitute.
- F. Once submittals are approved or approved as noted, they will be scanned and converted to PDF documents with OCR (optical character recognition) and given to the owner.

1.04 CONTRACTOR'S CONSTRUCTION SCHEDULE (LINEAR BAR CHART SCHEDULE)

- A. Linear bar chart time control schedule
1. Work overtime, nights, and weekends, as necessary to maintain schedule.
 2. Overtime, night, and weekend work will be at no additional cost to the Owner.
 3. Expedite approvals and deliveries of material so as not to delay job progress.
- B. Contract Modifications: For each proposed contract modification and concurrent with its submission, demonstrate the effect of the proposed change on the project schedule.
- C. Schedule Updating: Concurrent with making revisions to schedule, prepare tabulated reports showing the following:
1. Identification of activities that have changed.
 2. Changes in start dates.
 3. Changes in finish dates.
 4. Changes in the Contract Time.

1.05 SUBMITTAL LOG

- A. After development and acceptance of the Contractor's construction schedule, prepare a complete log of submittals.
 - 1. Coordinate submittals log with the list of subcontracts, schedule of values and the list of products as well as the Contractor's construction schedule.
 - 2. Prepare the log in chronological order; include all submittals required. Provide the following information:
 - a. Scheduled date for the first submittal
 - b. Related Section number
 - c. Submittal category
 - d. Name of subcontractor
 - e. Description of the part of the work covered
 - f. Scheduled date for resubmittal
 - g. Scheduled date the Architect's final release or approval.
 - 3. All submittals must be received within the first 25% of contract time.
- B. Distribution: Following response to initial submittal, print and distribute copies to the Project Manager, subcontractors, and other parties required to comply with submittal dates indicated. Post copies in the project meeting room and field office.
 - 1. When revision are made, distribute to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in construction activities.
- C. Log Updating: Revise the log after each meeting or activity, where revisions have been recognized or made. Issue the updated schedule concurrently with report of each meeting.

1.06 DAILY CONSTRUCTION REPORTS

- A. Prepare a daily construction report, recording the following information concerning events at the site; and submit duplicate copies to the Project Manager at weekly intervals:
 - 1. List of subcontractors at the site
 - 2. Approximate count of personnel at the site
 - 3. High and low temperatures, general weather conditions
 - 4. Accidents and unusual events
 - 5. Meetings and significant decisions
 - 6. Stoppages, delays, shortages, losses
 - 7. Meter readings and similar recordings
 - 8. Emergency procedures
 - 9. Orders and requests of governing authorities
 - 10. Change Orders received, implemented
 - 11. Services connected, disconnected
 - 12. Equipment or system tests and start-ups

13. Partial completions, occupancies
14. Substantial Completions authorized

1.07 SHOP DRAWINGS

- A. Submit newly prepared information, drawn to accurate scale. Highlight, encircle, or otherwise indicate deviations from the Contract Documents. Do not reproduce Contract Documents or copy standard information as the basis of Shop Drawings. Standard information prepared without specific reference to the Project is not considered a Shop Drawings and will be rejected.
- B. Shop Drawings include fabrication and installation drawings, setting diagrams, schedules, patterns, templates and similar drawings. Include the following information:
 1. All required dimensions
 2. Identification of products and materials included
 3. Compliance with specified standards
 4. Notation of coordination requirements
 5. Notation of dimensions established by field measurement
 6. Sheet Size: Except for templates, patterns and similar full-size Drawings on sheets at least 8 1/2" x 11" but no larger than 24" x 36".
 7. Initial Submittal: Submit one correctable translucent reproducible print and one blue-or black-line print for the Project Manager's review; the reproducible print will be returned.
 8. Initial Submittal: Submit 2 blue-or black-line prints for the Architect's review; one will be returned.
 9. Final Submittal: Submit 5 blue-or black-line prints; submit 7 prints where required for maintenance manuals. 3 prints will be retained; the remainder will be returned.
 10. Final Submittal: Submit 3 blue-or black-line prints; submit 5 prints where required for maintenance manuals. 2 prints will be retained; the remainder will be returned.
 - a. One of the prints returned shall be marked-up and maintained as a Record Documents.
 11. Do not use Shop Drawings without an appropriate final stamp indicating action taken in connections with construction.
- C. Coordination drawings are a special type of Shop Drawing that show the relationship and integration of different construction elements that require careful coordination during fabrication or installation to fit in the space provided or function as intended.
 1. Preparation of coordination Drawings is specified in section Project Coordination and may include components previously shown in detail on Shop Drawings or Product Data.
 2. Contractor is not entitled to additional payments due to lack of compliance with this Section.

1.08 PRODUCT DATA

- A. Collect Product Data into a single submittal for each element of construction or system. Product Data includes printed information such as manufacturer's installation instructions, catalog cuts, standard color charts, roughing-in diagrams and templates, standard wiring diagrams and performance curves. Where Product Data must be specially prepared because standard printed data is not suitable for use, submit as a Shop Drawing.
1. Mark each copy to show applicable choices and options. Where printed Product Data includes information on several products, some of which are not required, mark copies to indicate the applicable information. Include the following information:
 - a. Manufacturer's printed recommendations
 - b. Compliance with recognized trade association standards
 - c. Compliance with recognized testing agency standards
 - d. Application of testing agency labels and seals
 - e. Notation of dimensions verified by field measurement
 - f. Notation of coordination requirements
 - g. Manufacturers local representative and phone number.
 2. Do not submit Product Data until compliance with requirements of the Contract Documents has been confirmed.
 3. Preliminary Submittal: Submit a preliminary single-copy of Product Data where selection of options is required.
 4. Submittals: Submit six (6) copies of each required submittal. The Project Manager will return two (2) sets to the Contractor marked with action taken and corrections or modifications required.
 - a. Unless noncompliance with Contract Document provisions is observed, the submittal may serve as the final submittal.
 5. Distribution: Furnish copies of final submittal to installers, subcontractors, suppliers, manufacturers, fabricators, and others required for performance of construction activities. Show distribution on transmittal forms.
 - a. Do not proceed with installation until an applicable copy of Product Data applicable is in the Installer's possession.
 - b. Do not permit use of unmarked copies of Product Data in connection with construction.

1.09 SAMPLES

- A. Submit full-size, fully fabricated Samples cured and finished as specified and physically identical with the material or product proposed. Samples include partial sections of materials, color range sets, and swatches showing color, texture and pattern.
1. Mount, display, or package Samples in the manner specified to facilitate review of qualities indicated. Prepare Samples to match the Architect's/Owner's Sample. Include the following:

- a. Generic description of the Sample
 - b. Sample source
 - c. Product name or name of manufacturer
 - d. Compliance with recognized standards
 - e. Availability and delivery time
2. Submit Samples for review of kind, color, pattern, and texture, for a final check of these characteristics with other elements, and for a comparison of these characteristics between the final submittal and the actual component as delivered and installed.
 - a. Where variation in color, pattern, texture or other characteristics are inherent in the material or product represented, submit multiple units (not less than 3), that show approximate limits of the variations.
 - b. Refer to other Specification Sections for requirements for Samples that illustrate workmanship, fabrication techniques, details of assembly, connections, operation and similar construction characteristics.
 3. Preliminary submittals: Where Samples are for selection of color, pattern, texture or similar characteristics from a range of standard choices, submit a full set of choices for the material or product.
 - a. Preliminary submittals will be reviewed and returned with the Architect's/Owner's mark indicating selection and other action.
 4. Submittals: Except for Samples illustrating assembly details, workmanship, fabrication techniques, connections, operation and similar characteristics, submit 3 sets; one will be returned marked with the action taken.
 5. Maintain sets of Samples, as returned, at the project site, for quality comparisons throughout the course of construction.
 - a. Unless noncompliance with Contract Document provisions is observed, the submittal may serve as the final submittal.
 - b. Sample sets may be used to obtain final acceptance of the construction associated with each set.
- B. Distribution of Samples: Prepare and distribute additional sets to subcontractors, manufacturers, fabricators, suppliers, installers, and others as required for performance of the Work. Show distribution on transmittal forms.
1. Field Samples specified in individual sections are special types of Samples. Field Samples are full-size examples erected on site to illustrate finishes, coatings, or finish materials and to establish the standard by which the work will be judged.
 - a. Comply with submittal requirements. Process transmittal forms to provide a record of activity.

1.10 ARCHITECT'S ACTION

- A. Except for submittals for record, information or similar purposes, where action and return is required or requested, the Architect/Project Manager will review each submittal, mark to indicate action taken, and return promptly.
 - 1. Compliance with specified characteristics is the Contractor's responsibility.
- B. Action Stamp: The Architect will stamp each submittal with a uniform, self-explanatory action stamp. The stamp will be appropriately marked, similarly as follows, to indicate the action taken:
 - 1. Final Unrestricted Release: Work may proceed, provided it complies with contract documents, when submittal is returned with the following: "No Exceptions Taken"
 - 2. Final-But Restricted Release: Work may proceed, provided it complies with notations and corrections on submittal and with contract documents, when submittal is returned with the following: "Note Comments"
 - 3. Returned for Resubmittal: Do not proceed with work. Revise submittal in accordance with notations thereon, and resubmit without delay to obtain a different action marking. Do not allow submittals with the following marking (or unmarked submittals where a marking is required) to be used in connection with performance of the work: "Resubmit"
 - a. Do not permit submittals marked 'Revise and Resubmit' to be used at the Project site, or elsewhere where work is in progress.
 - 4. Rejected: Submittal does not comply with requirements of the Contract Documents. Submittal must be discarded and entirely new submittal shall be forward to the Project Manager without delay: "Rejected"

PART 2 PRODUCTS

(Not Applicable)

PART 3 Execution

(Not Applicable)

END OF SECTION 01300

SECTION 01380
CONSTRUCTION PHOTOGRAPHS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including Contractual Conditions and other Division-1 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. General: This Section specifies administrative and procedural requirements for construction photographs.

1.03 SUBMITTALS

- A. Photographs: Submit actual RAW images

PART 2 PRODUCTS
Not Used

PART 3 EXECUTION

3.01 PHOTOGRAPHIC REQUIREMENTS

- 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.
 - 1. Maintain key plan with each set of construction photographs that identifies each photographic location.
- 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. 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.
 - 2. Date and Time: Include date and time in file name for each image.
- C. Periodic Construction Photographs: Subject to Owner approval, take twelve color photographs monthly, coinciding with cut-off date associated with each Application for Payment. Select interior vantage points to best show status of construction and progress since last photographs were taken.
 - 1. Subject to Owner approval, take photographs for each submittal from the same viewpoint unless specifically directed otherwise by Architect.

- D. Final Completion Construction Photographs: Subject to Owner approval, take twelve color photographs after date of Substantial Completion for submission as Project Record Documents. Architect will direct photographer for desired vantage points.

END OF SECTION 01380

SECTION 01400
QUALITY CONTROL SERVICES

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. This Section specifies administrative and procedural requirements for quality control services.
- B. Quality control services include inspections and tests and related actions including reports, performed by independent agencies, governing authorities, and the Contractor. They do not include Contract enforcement activities performed by the Architect.
- C. Inspection and testing services are required to verify compliance with requirements specified or indicated. These services do not relieve the Contractor of responsibility for compliance with Contract Document requirements.
- D. Requirements of this Section relate to customized fabrication and installation procedures, not production of standard products.
 - 1. Specific quality control requirements for individual construction activities are specified in the Sections that specify those activities. Those requirements, including inspections and test, cover production of standard products as well as customized fabrication and installation procedures.
 - 2. Inspection, test and related actions specified are not intended to limit the Contractor's quality control procedures that facilitates compliance with Contract Document requirements.
 - 3. Requirements for the Contractor to provide quality control services required by the Architect, Owner, or authorities having jurisdiction are not limited by provisions of this Section.

1.03 GENERAL QUALITY CONTROL

- A. The Contractor shall be responsible for maintaining and ensuring quality control over subcontractors, suppliers, manufacturers, materials, equipment, products, services, site conditions and workmanship to product work of specified quality. The completed work shall be of high quality throughout.

1.04 WORKMANSHIP

- A. Comply with well-known standards recognized by each trade except when more restrictive tolerances or specified requirements indicate more rigid standards or

more precise workmanship.

- B. Perform work by persons qualified to produce workmanship of specified quality. Said qualifications shall be determined by well-known standards recognized by the trade for each respective portion of contract work.
- C. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration and racking.

1.05 MANUFACTURER'S INSTRUCTIONS

- A. Comply with instructions in full detail, including each step in sequence. Should instructions conflict with Contract Documents, request clarification from Architect before proceeding.

1.06 MANUFACTURER'S CERTIFICATES

- A. When required by individual Specifications Section, submit manufacturer's certificate and supporting documentation, in duplicate, that products meet or exceed specified requirements.
- B. ASBESTOS FREE MATERIALS - Manufacturer and/or supplier shall provide a written and notarized statement on manufacturer's company letterhead to certify and warrant that product (s) utilized on project are asbestos free.

1.07 MOCKUPS

- A. When required by individual Specifications Section, erect complete, full scale mockup of assembly at Project Site.

1.08 MANUFACTURER'S FIELD SERVICES

- A. When specified in respective Specification Sections, require supplier and/or manufacturer to provide qualified personnel to observe field conditions, conditions of surfaces and installation, quality of workmanship, test, adjust and balance of equipment as applicable and to make appropriate recommendations.
- B. Representative shall submit written report to Owner listing observations, recommendations, and certifying full conformance and compliance with manufacturers standards or requirements.

1.09 TESTING LABORATORY SERVICES

- A. The County shall employ and pay for services of an Independent Testing Laboratory to perform inspections, tests for construction materials (soils, concrete) and threshold inspections.
- B. Services will be performed in accordance with requirements of governing authorities and with specified standards.
- C. Reports will be submitted to the County, Contractor and Architect giving

observations and results of tests, indicating compliance or noncompliance with specified standards and with Contract Documents.

- D. Contractor shall cooperate with testing laboratory personnel; furnish tools, samples of materials, design, mix equipment, storage and assistance as requested.
 - 1. The contractor shall be responsible for notifying the testing laboratory at least 24 hours prior to expected time for operations requiring testing services. Longer length of notice to testing laboratory shall be provided by Contractor when required by the testing laboratory to ensure the timely scheduling and performance of all tests required.
 - 2. The Contractor is responsible for obtaining and paying tests including but not limited to test and balance, portable water bacteriological tests and test required in individual sections throughout the Project Manual.
- E. The costs of any tests which fail will be paid for by the Contractor. The amount to be reimbursed to the County by the Contractor, will be the amount invoiced to the County by the testing laboratory in accordance with the testing services fees set forth in its contract with the County.

1.10 TEMPERATURE/HUMIDITY LOG

- A. The Contractor shall be responsible for preparing rain, temperature and humidity measuring devices at the project site and maintaining a log of temperature and humidity measurements.
- B. Said log shall contain a daily record of exterior temperature, rainfall amount and humidity conditions and where environmental conditions are specified in individual sections, a daily record of the temperature and humidity conditions where the work of those sections is stored and installed.
- C. The Temperature/Humidity Log shall be available to the Project Manager as part of the Contract Documents.

1.11 RESPONSIBILITIES

- A. The Owner shall provide inspections, tests and similar quality control services, specified in individual Specification Sections and these services include those specified to be performed by an independent agency and not by the Contractor.
- B. The Contractor shall cover all costs of tests or inspections to evaluate means and methods of installation performed as a substitution and not as originally specified.
 - 1. Re-testing: The Contractor is responsible for re-testing where results of required inspections, test or similar services prove unsatisfactory and do not indicate compliance with Contract Documents requirements, regardless of whether the original test was the Contractor's responsibility.
 - a. Cost of re-testing construction revised or replaced by the Contractor is the Contractor's responsibility, where required tests were

performed on original construction.

2. Associated Services: The Contractor shall cooperate with agencies performing required inspections, tests and similar services and provide reasonable auxiliary services as requested. Notify the agency sufficiently in advance of operations to permit assignment of personnel. Auxiliary services required include, but are not limited to:
 - a. Providing access to the work and furnishing incidental labor and facilities necessary to facilitate inspections and tests.
 - b. Taking adequate quantities of representative samples of materials that require testing or assisting the agency in taking samples.
 - c. Providing facilities for storage and curing the test samples.
 - d. Providing the agency with a preliminary design mix proposed for use for materials mixes that require control by the testing agency.
 - e. Security and protection of samples and test equipment at the Project site.
- C. Duties of the Testing Agency: The independent testing agency engages to perform inspections, sampling and testing of materials and construction specified in individual Specification Sections shall cooperate with Architect and Contractor in performance of its duties, and shall provide qualified personnel to perform required inspections and tests.
1. The agency shall notify the Architect and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
 2. The agency is not authorized to release, revoke, alter or enlarge requirements of the Contract Documents, or approve or accept any portion of the Work.
 3. The agency shall not perform any duties of the Contractor.
- D. Coordination: The Contractor and each agency engaged to perform inspection, tests and similar services shall coordinate the sequence of activities to accommodate required services with a minimum of delay. In addition, the Contractor and each agency shall coordinate activities to avoid the necessity of removing and replacing construction to accommodate inspections and tests.
1. The Contractor is responsible for scheduling times for inspections, tests, taking samples and similar activities.

1.12 SUBMITTALS

- A. Qualification for Service Agencies: Engage inspection and testing service agencies, including independent testing laboratories, which are pre-qualified as complying with Recommended Requirements for Independent Laboratory qualification by the American Council of Independent Laboratories, and which specialize in the types of inspections and tests to be performed.
1. Each independent inspection and testing agency engages on the Project

shall be authorized by authorities having jurisdiction to operate in the State in which the Project is located.

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION

3.01 REPAIR AND PROTECTION

- A. General: Upon completion of inspection, testing, sample-taking and similar services, repair damaged construction and restore substrates and finished to eliminate deficiencies, including deficiencies in visual qualities of exposed finishes. Comply with Contract Document requirements for Cutting and Patching.
- B. Protect construction exposed by or for quality control service activities, and protects and repaired construction.
- C. Repair and protection is the Contractor's responsibility regardless of the assignment of responsibility for inspection, testing or similar services.

END OF SECTION 01400

SECTION 01410
TESTING LABORATORY SERVICES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Selection and payment
- B. Contractor Submittals
- C. Laboratory responsibilities
- D. Laboratory reports
- E. Limits on testing laboratory authority
- F. Contractor responsibilities
- G. Schedule of inspections and tests

1.02 REFERENCES

- A. ANSI/ASTM D3740 - Practice for Evaluation of Agencies Engages in testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction.
- B. ANSI/ASTM E329 - Recommended Practice for Inspection and Testing Agencies for Concrete, Steel, and Bituminous Materials as Used in Construction.

1.03 SELECTION AND PAYMENT

- A. Owner will employ and pay for services of an independent testing laboratory to perform specified inspection and testing.
- B. Employment of testing laboratory shall in no way relieve Contractor of obligation to perform work in accordance with requirements of Contract Documents.

1.04 QUALITY ASSURANCE

- A. Comply with requirements of ANSI/ASTM E329 and ANSI/ASTM D3740
- B. Laboratory: Authorized to operate in state in which Project is located.
- C. Laboratory Staff: Maintain a full time registered Engineer on staff to review services.
- D. Testing Equipment: Calibrated at reasonable intervals with devices of an accuracy traceable to either National Bureau of Standards (NBS) Standards or accepted values of natural physical constants.

1.05 LABORATORY RESPONSIBILITIES

- A. Test samples of mixes
- B. Provide qualified personnel at site when required. Cooperate with Orange County and Contractor in performance of services.
- C. Perform specified inspection, sampling, and testing of Products in accordance with specified standards.
- D. Ascertain compliance of materials and mixes with requirements of Contract Documents.
- E. Promptly notify Orange County and Contractor of observed irregularities or non-conformance of Work or Products.
- F. Perform additional inspections and test required by Orange County.
- G. Attend preconstruction conferences and progress meetings.

1.06 LABORATORY REPORTS

- A. After each inspection and test, promptly submit four copies of laboratory report to Orange County, and to Contractor.
- B. Include:
 - 1. Date issued
 - 2. Project title and number
 - 3. Name of inspector
 - 4. Data and time of sampling or inspection
 - 5. Identification of product and Specifications Section
 - 6. Location in the Project
 - 7. Type of inspection or test
 - 8. Date of test
 - 9. Results of tests
 - 10. Conformance with Contract Documents
- C. When requested by Orange County, provide interpretation of test results.

1.07 LIMITS ON TESTING LABORATORY AUTHORITY

- A. Laboratory may not release, revoke, alter, or enlarge on requirements of Contract Documents.
- B. Laboratory may not approve or accept any portion of the work.
- C. Laboratory may not assume any duties of Contractor
- D. Laboratory has no authority to stop the work.

1.08 CONTRACTOR RESPONSIBILITIES

- A. Cooperate with laboratory personnel, and provide access to the work.
- B. Provide incidental labor and facilities to provide access to work to be tested, to obtain and handle samples at the site or at source of products to be tested, to facilitate tests and inspections, storage and curing of test samples.
- C. Notify Orange County and laboratory 24 hours prior to expected time for operations requiring inspection and testing services.
- D. Arrange with laboratory and pay for additional samples and tests required by Contractor beyond specified requirements.

1.09 SCHEDULE OF INSPECTIONS AND TESTS

- A. Testing required:
 - 1. Provide concrete mix designs.
 - 2. Strength test for each 50 cubic yard of concrete placed.

END OF SECTION 01410

SECTION 01500
TEMPORARY FACILITIES

PART 1 GENERAL

1.01 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.

1.02 SUMMARY

- A. This Section specifies requirements for temporary services and facilities, including utilities, construction and support facilities, security and protection.
- B. Actual requirements for temporary facilities will be determined after the bid is awarded, with the successful bidder.
- C. Temporary utilities required include but are not limited to:
 - 1. Water service and distribution
 - 2. Temporary electric power and light
 - 3. Telephone service
 - 4. Sanitary facilities
- D. Temporary construction and support facilities required include but are not limited to:
 - 1. Temporary heat and ventilation as required to facilitate construction process and personnel.
 - 2. Field office and storage sheds.
 - 3. Sanitary facilities, including drinking water.
 - 4. Temporary enclosures.
 - 5. Hoists and temporary elevator use.
 - 6. Temporary project identification signs and bulletin boards
 - 7. Waste disposal services.
 - 8. Rodent and pest control
 - 9. Construction aids and miscellaneous services and facilities.
- E. Security and protection facilities required include but are not limited to:
 - 1. Temporary fire protections
 - 2. Barricades, warning signs, lights
 - 3. Sidewalk bridge or enclosure fence for the site.
 - 4. Environmental protection
 - 5. Fencing
 - 6. Barriers
 - a. Contractor shall be responsible for providing a temporary 6' high chain link construction fence around the entire perimeter of the construction site. Fence shall be removed upon completion of the job. Limits of construction fence indicate on the site plan drawings.

- b. Contractor shall be responsible for providing security measures as required to prevent public entry to construction areas and adjacent properties from damage from construction operations.
 - c. Contractor shall be responsible for providing a protective barrier around trees and plants designated to remain as indicated in plans. Project against vehicular traffic, stored materials, dumping, chemically injurious materials and puddling or continuous running water.
7. Enclosures
- a. Provide temporary weather-tight closures of openings in exterior surfaces to provide acceptable working conditions and protection for materials, in allow for temporary heating, and to prevent entry of unauthorized persons. Provide temporary doors with self-closing hardware and locks.
8. Protection of Installed Work
- a. Provide temporary protection for installed products. Control work and traffic in immediate area to avoid damage.
 - b. Provide protective coverings at walls, projections, jambs, sills and soffits of openings. Provide barriers or coverings to protect roof and finished floors and stairs from work and traffic, movement of heavy objects and storage.
 - c. Prohibit work, traffic and storage on waterproofed and roofed surfaces, and on lawn and landscaped areas that is not a part of the work for those surfaces and areas.

1.03 SUBMITTALS

- A. Temporary Utilities: Submit reports of tests, inspections, meter readings and similar procedures performed on temporary utilities.
- B. Demising Wall Plan: Submit a plan at the Pre-Construction meeting indication the location, construction, and extent of demising walls. Includes connection details indicating method of installation and attachment.

1.04 QUALITY ASSURANCE

- A. Regulations: Comply with industry standards and applicable laws and regulations if authorities having jurisdiction, including but to limited to:
 - 1. Building Code requirements
 - 2. Health and safety regulations
 - 3. Utility company regulations
 - 4. Police, Fire Department and Rescue Squad rules
 - 5. Environmental Protection regulations
- B. Standards: Comply with NFPA Code 241, 'Building Construction and Demolition Operations', ANSI-A10 Series standards for 'Safety Requirements for Construction and Demolition', and NECA Electrical Design Library 'Temporary Electrical Facilities'.
 - 1. Refer to 'Guidelines for Bid Conditions for Temporary Job Utilities and

Services', prepared jointly by AGC and ASC, for industry recommendations.

2. Electrical Services: Comply with NEMA, NECA and UL standards and regulations for temporary electric service. Install service in compliance with National Electric Code (NFPA 70).
- C. Inspections: Arrange for authorities having jurisdiction to inspect and test each temporary utility before use. Obtain required certifications and permits.

1.05 PROJECT CONDITIONS

- A. Temporary Utilities: Prepare a schedule indicating dates for implementation and termination of each temporary utility. At the earliest feasible time, when acceptable to the Owner, change over from use of temporary service to use for the permanent service.
- B. Conditions of Use: Keep temporary services and facilities clean and neat in appearance. Operate in a safe and efficient manner. Take necessary fire prevention measures. Do not overload facilities, nor permit them to interfere with progress. Do not allow hazardous dangerous, unsanitary conditions, nor public nuisances to develop or persist on the site.
- C. Water Control: Grade site to drain. Maintain excavations free of water. Provide and operate pumping equipment if necessary. Provide silt barriers required by the Florida Department of Transportation St. Johns and any other authority having jurisdiction over the Project.
- D. Cleaning During Construction: Control accumulation of waste materials and rubbish so as to maintain a neat, clean and orderly and safe project; periodically dispose of off-site as needed.

Clean interior areas prior to start of finish work, maintain areas free of dust and other contaminants during finishing operations.

- E. Field Office and Sheds: Office: Weather-tight with lighting, electrical outlets, heating, cooling, and ventilating equipment, and equipped with furniture.

Storage Sheds for Tools, Materials, and Equipment: Weather-tight with adequate space for organized storage and access, and lighting for inspection of stored materials.

Contractor provide 10 x 8 minimum size office with plan table, telephone, heat, a/c for projects exceeding 10,000 sq. ft. building area.

- F. Protection of Adjacent Properties: Locate on site construction operations that will generate noise and/or dust as far as practical from occupied structures on adjacent properties so as to minimize disturbances to the occupants of these structures or properties.

Prevent dust or other contaminants caused by construction operations for this Project from being carried to adjacent properties by installation of protective barriers

and/or suspension of construction operations during high winds.

Dispose of all construction debris which may be carried to adjacent properties by winds. Remove debris daily and/or more often as required to prevent contamination of adjacent properties.

- G. Removal: Remove temporary materials, equipment and construction facilities prior to Substantial Completion inspection.

Remove temporary utility services prior to Final Completion Inspection.

Clean and repair damage caused by installation or use of temporary facilities. Remove underground installations; grade and complete all work on site as indicated.

- H. Conversion to Public Utilities: General Contractor is to coordinate and arrange with the appropriate utility service providing agencies and make arrangements for the installation and connection to final utilities prior to Final Completion inspection.

General Contractor shall provide any and all coordination, scheduling and layouts as may be required by the service utilities.

PART 2 PRODUCTS

2.01 MATERIALS

- A. General: Provide new materials; of acceptable to the Project Manager, undamaged previously used materials in serviceable condition maybe used. Provide materials suitable for the use intended.

- B. Lumber and Plywood:

1. For job-built temporary offices, shops and sheds within the construction area, provide UL labeled, fire treated lumber and plywood for framing, sheathing and siding.
2. For fences and vision barriers, provide exterior type, minimum 3/8" thick plywood.
3. For safety barriers, sidewalk bridges and similar uses, provide minimum 5/8" thick exterior plywood.

- C. Paint:

1. For job-built temporary offices, shops, sheds, fences and other exposed lumber and plywood, provide exterior grade acrylic-latex emulsion over exterior primer.
2. For interior walls of temporary offices, provide two coats interior latex flat wall paint.

- D. Tarpaulins: Provide waterproof, fire-resistant, UL labeled tarpaulins with flame-

spread rating of 15 or less. For temporary enclosure provide translucent nylon reinforced laminated polyethylene or polyvinyl chloride fire retardant tarpaulins.

- E. Water: Provide portable water approved by local health authorities.
- F. Open-Mesh Fencing: Provide 11-gage, galvanized 2-inch, chain link fabric fencing 6-feet high with galvanized barbed wire top strand and galvanized steel pipe post, 1 2" I.D. for line posts and 2 2 I.D. for corner posts.

2.02 EQUIPMENT

- A. General: Provide new equipment: if acceptable to the Project Manager, undamaged, previously used equipment in serviceable condition may be used. Provide equipment suitable for use intended.
- B. Water Hoses: Provide 3/4" heavy-duty, abrasion-resistant, flexible rubber hoses 100 ft. Long, with pressure rating greater than the maximum pressure of the water distribution system. Provide adjustable shut-off nozzles at hose discharge.
- C. Electrical Outlets: Provide properly configured NEMA polarized outlets to prevent insertion of 110-120 volt plugs into higher voltage outlets. Provide receptacle outlets equipped with ground-fault circuit interrupters, reset bottom and pilot light, for connection of power tools and equipment.
- D. Electrical Power Cords: Provide grounded extension cords; use Ahard-service≅ cords where exposed to abrasion and traffic. Provide water proof connectors to connect separate lengths of electric cords, if single lengths will not reach areas where construction activities are in progress.
- E. Lamps and Light Fixtures: Provide general service incandescent lamps of wattage required for adequate illumination. Provide guard cages or tempered glass enclosures, where exposed to breakage. Provide exterior fixtures where exposed to moisture.
- F. Heating Units: Provide temporary heating units that have been tested and labeled by UL, FM or another recognized trade association related to the type of fuel being consumed.
- G. Temporary Offices: Provide prefabricated or mobile units or similar job-built construction with lockage entrances, operable windows and serviceable finished. Provide heated and air-conditioned units on foundations adequate for normal loading.
- H. Temporary Toilet Units: Provide self-contained single-occupant toilet units of the chemical, aerated recirculation, or combustion type, properly vented and fully enclosed with a glass fiber reinforced polyester shell or similar nonabsorbent material.
- I. First Aid Supplies: Comply with governing OSHA and any other regulations.
- J. Fire Extinguishers: Provide hand-carried, portable UL-rated, class AA≅ fire

extinguishers for temporary offices and similar spaces. In other locations provide hand-carried, portable UL-rated, class 'ABC' dry chemical extinguishers, or a combination of extinguishers of NEPA recommended classes for the exposures.

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

PART 3 EXECUTION

3.01 INSTALLATION

- A. Use qualified personnel for installation of temporary facilities. Locate facilities where they will serve the project adequately and result in minimum interference with performance of the work. Relocate and modify facilities as required.
- B. Provide each facility ready for use when needed to avoid delay. Maintain and modify as required. Do not remove until facilities are no longer needed, or are replaced by authorized use of completed permanent facilities.

3.02 TEMPORARY UTILITY INSTALLATION

- A. General: Engage the appropriate local utility company to install temporary service or connect to existing service. Where the company provides only part of the service, provide the remainder with matching, compatible materials and equipment; comply with the company's recommendations.
 1. Arrange with the company and existing users for a time when service can be interrupted, where necessary, to make connections for temporary services.
 2. Provide adequate capacity at each stage of construction. Prior to temporary utility availability, provide trucked-in services.
 3. Obtain easements to bring temporary utilities to the site, where the Owner's easements cannot be used for that purpose.
 4. Use Charges: Cost of use charges for temporary facilities are not chargeable to the Owner or Architect, and will not be acceptable as a basis of claims for a Change Order.
- B. Water Service: Install water service and distribution piping of sized and pressures adequate for construction until permanent water service is in use.
- C. Temporary Electric Power Service: Provide weatherproof, grounded electric power service and distribution system of sufficient size, capacity, and power characteristics during construction period. Include meters, transformers, overload protected disconnects, automatic ground-fault interrupters and main distribution switch gear.
 1. Coordinate with the Owner for HVAC shutdown and return air systems in Project work areas.
 2. In addition to the demising wall installation, and providing air filtration specified, shutdown the return air systems in each area where Work

- activities are underway. Re-establish the return air systems as work is completed.
3. Provide temporary HVAC to maintain the existing level of service during shutdown periods.
- D. Temporary Lighting: Whenever overhead floor or roof deck has been installed, provide temporary lighting with local switching.
1. Install and operate temporary lighting that will fulfill security and protection requirements, without operating the entire system, and will provide adequate illumination for construction operations and traffic conditions.
- E. Temporary Telephones: Provide temporary telephone service for all personnel engaged in construction activities, throughout the construction period. Install telephone on a separate line for each temporary office and first aid station. Where an office has more than two occupants, install a telephone for each additional occupant or pair of occupants.
1. At each telephone, post a list of important telephone numbers.
- F. Sewers and Drainage: If sewers are available, provide temporary connections to remove effluent that can be discharged lawfully. If sewers are not available or cannot be used, provide drainage ditches, dry wells, stabilization ponds and similar facilities. If neither sewers nor drainage facilities can be lawfully used for discharge or effluent, provide containers to remove and dispose of effluent off the site in a lawful manner.
1. Filter out excessive amounts of soil, construction debris, chemicals, oils and similar contaminants that might clog sewers or pollute waterways before discharge.
- G. Provide earthen embankments and similar barriers in and around excavations and subgrade construction, sufficient to prevent flooding by run-off of storm water from heavy rains.

3.03 TEMPORARY CONSTRUCTION AND SUPPORT FACILITIES INSTALLATION

- A. Locate field offices, storage sheds, sanitary facilities and other temporary construction and support facilities for easy access.
1. Maintain temporary construction and support facilities until Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to the Owner.
- B. Provide incombustible construction for offices, shops and sheds located within the construction area or within 30 feet of building lines. Comply with requirements of NFPA 241.
- C. Temporary Heat: Provide temporary heat required by construction activities, for curing or drying of completed installations or protection of installed construction from

adverse effects of low temperatures or high humidity. Select safe equipment that will not have a harmful effect on completed installations or elements being installed. Coordinate ventilation requirements to produce the ambient condition required and minimize consumption of energy.

- D. Heating Facilities: Except where use of the permanent system is authorized, provide electric vented self-contained LP gas or fuel oil heaters with individual thermostatic control.
 - 1. Use of gasoline-burning space heaters, open flame, or salamander type heating units is prohibited.
- E. Storage and Fabrication Sheds: Install storage and fabrication sheds, sized, furnished and equipped to accommodate materials and equipment involved, including temporary utility service. Sheds maybe open shelters or fully enclosed spaces with the building or elsewhere on the site.
- F. Temporary Paving: Construct and maintain temporary roads and paving to support the indicated loading and to withstand exposure to traffic during the construction period. Locate temporary paving the roads, storage areas and parking where the same permanent facilities will be located. Review proposed modifications to permanent paving with the Architect.
 - 1. Coordinate temporary paving development with subgrade grading, compaction, installation, and stabilization of sub-base, and installation of base and finish courses of permanent pavings.
 - 2. Install temporary paving to minimize the need to rework the installations and to result in permanent reads and paved areas that are without damage or deterioration when occupied by the Owner.
 - 3. Delay installation of the final course of permanent asphalt concrete paving until immediately before Substantial Completion. Coordinate with either conditions to avoid unsatisfactory results.
 - 4. Extend temporary paving in and around the construction area as necessary to accommodate delivery and storage of materials, equipment usage, administration and supervision.
 - 5. Paving: Comply with Division 2 Section "Asphalt Concrete Paving" or construction and maintenance of temporary paving.
- G. Sanitary facilities include temporary toilets, wash facilities and drinking water fixtures. Comply with regulations and health codes for the type, number, location, operation and maintenance of fixtures and facilities. Install where facilities will best serve the Project's needs.
 - 1. Provide toilet tissue, paper towels, paper cups and similar disposable materials for each facility. Provide covered waste containers for used material.

- H. Toilets: Install self-contained toilet units. Shield toilets to ensure privacy. Use of pit-type privies will not be permitted. Provide one toilet for each 15 workers on site and have serviced weekly as a minimum.
- I. Wash Facilities: Install wash facilities supplied with portable water at convenient locations for personnel involved in handling materials that require wash-up for a healthy and sanitary condition. Dispose of drainage properly. Supply cleaning compounds appropriate for each condition.
 - 1. Provide safety showers, eye-wash fountains and similar facilities for convenience, safety and sanitation of personnel.
- J. Drinking Water Fixtures: Provide drinking water fountains including paper supply.
 - 1. Where power is accessible, provide electric water coolers to maintain dispensed water temperature at 45 to 55 degree F (7 to 13 degree C).
- K. Dewatering Facilities and Drains: For temporary drainage and dewatering facilities and operations not directly associated with construction activities included under individual Sections, comply with dewatering requirements of applicable Division 2 Sections. Where feasible, utilize the same facilities. Maintain the site, excavations and construction free of water.
- L. Demising Walls: Provide temporary enclosure for protection of construction in progress and completed, from exposure, foul weather, other construction operations and similar activities.
 - 1. Where heat is needed and the permanent building enclosure is not complete, provide temporary enclosures where there is no other provision for containment of heat. Coordinate enclosure with ventilating and material drying or curing requirements to avoid dangerous conditions and effects.
 - 2. Install tarpaulins securely, with incombustible wood framing and other materials. Close openings of 25 square feet or less with plywood or similar materials.
 - 3. Close openings through floor or roof decks and horizontal surfaces with load-bearing wood-framed construction.
 - 4. Where temporary wood or plywood enclosure exceeds 100 square feet in area, use UL-labeled fire-retardant treated material for framing and main sheathing.
- M. Temporary Lifts and Hoist: Provide facilities for hoisting materials and employees. Truck cranes and similar devices used for hoisting material are considered 'tools and equipment' and not temporary facilities.
- N. Temporary Elevator Use: By permission of the Owner only. Obtain written permission prior to using elevator for any construction purposes.
- O. Project Identification and Temporary Signs: Prepare project identification and other

signs of the size indicated. Install signs where indicated to inform the public and persons seeking entrance to the Project. Support on posts or framing of preservative treated wood or steel. Do not permit installation of unauthorized signs.

1. Project Identification Signs: Engage an experienced sign painter to apply graphics. Comply with details indicated.
 2. Temporary Signs: Prepare signs to provide directional information to construction personnel and visitors.
- P. Temporary Exterior Lighting: Maintain exterior yard and sign lights so that signs are visible when work is being performed.
- Q. Collection and Disposal of Waste: Collect waste from construction areas and elsewhere daily. Comply with requirements of NFPA 241 for removal of combustible waste material and debris. Enforce requirements strictly. Do not hold materials more than 7 days during normal weather or 3 days when the temperature is expected to raise above 80 degree F (27 degree). Handle hazardous, dangerous, or unsanitary waste materials separately from other waste by containerizing properly. Dispose of materials in a lawful manner.
- R. Rodent and Pest Control: Before foundation work has been completed, retain a local exterminator or pest control company to recommend practices to minimize attraction and harboring of rodents, roaches and other pests. Employ this service to perform extermination and control procedures at regular intervals so the project will be relatively free of pests and their residues at Substantial Completion. Perform control operations in a lawful manner using environmentally safe materials.

3.04 SECURITY AND PROTECTIONS FACILITIES INSTALLATION

- A. Except for use of permanent fire protection as soon as available do not change over from use of temporary security and protection facilities to permanent facilities until Substantial Completion, or longer as requested by the Project Manager.
- B. Temporary Fire Protection: Until fire protection needs are supplied by permanent facilities of the types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 10 Standard for Portable Fire Extinguishers, and NFPA 141 Standard for Safeguarding Construction, Alternations and Demolition Operations.
1. Locate fire extinguishers where convenient and effective for their intended purpose, but not less than one extinguisher on each floor at or near each usable stairwell.
 2. Store combustible materials in containers in fire-safe locations.
 3. Maintain unobstructed access in fire extinguishers, fire hydrants, temporary fire protection facilities, stairways and other access routes for fighting fires. Prohibit smoking in hazardous fire exposure areas.
 4. Provide supervision of welding operations, combustion type temporary

heating units, and similar sources of fire ignition.

- C. Permanent Fire Protection: At the earliest feasible date in each area of the Project, complete installation of the permanent fire protection facility, including connected services, and place into operation and use. Instruct key personnel on use of facilities.
- D. Barricades, Warning Signs and Lights: Comply with standards and code requirements for erection of structurally adequate barricades. Paint with appropriate colors, graphics and warning signs to inform personnel and the public of the hazard being protected against. Where appropriate and needed, provide lighting including flashing red or amber lights.
- E. Enclosure Fence: When excavation begins, install an enclosure fence with lockable entrance gates. Locate where indicated, or enclose the entire site or the portion determined sufficient to accommodate construction operations. Install in a manner that will prevent people, dogs and other animals from easily entering the site, except by the entrance gates.
 - 1. Provide open-mesh, chain-link fencing with posts set in a compacted mixture of gravel and earth.
- F. Security Enclosure and Lockup: Install substantial temporary enclosure of partially completed areas of construction. Provide locking entrances to prevent unauthorized entrance, vandalism, theft and similar violations of security.
 - 1. Storage: Where materials and equipment must be stored, and are of value or attractive for theft, provide a secure lockup. Enforce discipline in connection with the installation and release of materials to minimize the opportunity for theft and vandalism.
- G. Environmental Protection: Provide protection, operate temporary facilities and conduct construction in ways and by methods that comply with environmental regulations, and minimize the possible that air, waterways and sub-soil might be contaminated or polluted, or that other undesirable effects might result. Avoid use of tools and equipment which product harmful poise. Restrict use of noise making tools and equipment to hours that will minimize complaints from persons or firms near the site.

3.05 OPERATION, TERMINATION AND REMOVAL

- A. Supervision: Enforce strict discipline in use of temporary facilities. Limit availability of temporary facilities to essential and intended uses to minimize waste and abuse.
- B. Maintenance: Maintain facilities in good operating condition until removal. Protect from damage by freezing temperatures and similar elements.
 - 1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation and similar facilities on a 24 hour day basis where required to achieve indicated results and to avoid possibility of damage.

2. Protection: Prevent water filled piping from freezing. Maintain makers for underground lines. Protect from damage during excavation operations.
- C. Termination and Removal: Unless the Architect requests that it be maintained longer, remove each temporary facility when the need has ended, or when 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 the 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 the Contractor. The Owner reserves the right to take possession of Project identification signs.
 2. Remove temporary paving that is not intended for or acceptable for integration into permanent paving. Where the area is intended for landscape development, remove soil and aggregate fill that does not comply with requirements for fill or subsoil in the area. Remove materials contaminated with road oil, asphalt and other petrochemical compounds, and other substances which might impair growth of plant materials or lawns. Repair or replace street pavings, curbs and sidewalks at the temporary entrances, as required by the governing authority.
 3. At Substantial Completion, clean and renovate permanent facilities that have been used during the construction period, including but not limited to:
 - a. Replace air filters and clean inside of ductwork and housings.
 - b. Replace significantly worn parts and parts that have been subject to unusual operating conditions.
 - c. Replace lamps that are burned out or noticeably dimmed by substantial hours of use as noted by the Owner's representative.

END OF SECTION 01500

SECTION 01600
MATERIALS AND EQUIPMENT

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. This Section specifies administrative and procedural requirements governing the Contractor's selection of products for use in the Project.
- B. The Contractor's Construction Schedule and the Schedule of Submittals are included under Section 01300 -Submittals.
- C. Administrative procedures for handling requests for substitutions made after award of the Contract are included under Section 01631 'Product Substitution'.

1.03 DEFINITIONS

- A. Definitions used in this Article are not intended to change the meaning of other terms used in the Contract Documents such as 'specialties', 'systems', 'structure', 'finishes', 'accessories', and similar terms. Such terms are self-explanatory and have well recognized meanings in the construction industry.
 - 1. 'Products' are items purchased for incorporation in the Work, whether purchased for the Project or taken from previously purchased stock. The term 'product' includes the term 'material', 'equipment', 'system' and terms of similar intent.
 - a. 'Named Products' are items identified by manufacturer's product name, including make or model designation, indicated in the manufacturer's published product literature, that is current as of the date of the Contract Documents.
 - b. 'Foreign Products', as distinguished from 'domestic products', are items substantially manufactured (50 percent or more of value) outside of the United States and its possessions; or produced or supplied by entities substantially owned (more than 50 percent) by persons who are not citizens nor living within the United States and its possessions.
 - 2. 'Materials' are products that are substantially shaped, cut, worked, mixed, finished, refined or otherwise fabricated, processed, or installed to form a part of the work.
 - 3. 'Equipment' is a product with operational parts, whether motorized or manually operated, that requires service connections such as wiring or piping.

1.04 QUALITY ASSURANCE

- A. Source Limitations: To the fullest extent possible, provide products of the same kind, from a single source.
- B. Compatibility of Options: When the Contractor is given the option of selecting between two or more products for use on the Project, the product selected shall be compatible with products previously selected, even if previously selected products were also options.
- C. Nameplates: Except for required labels and operating data, do not attach or imprint manufacturer's or producer's nameplates or trademarks on exposed surfaces of products which will be exposed to view in occupied spaces or on the exterior.
 - 1. Labels: Locate required product labels and stamps on a concealed surface or, where required for observation after installation, on accessible surface that is not conspicuous.
 - 2. Equipment Nameplates: Provide a permanent nameplate on each item of service-connected or power-operated equipment. Locate on an easily accessible surface which is inconspicuous in occupied spaces. The nameplate shall contain the following information and other essential operating data.
 - a. Name of product and manufacturer
 - b. Model and serial number
 - c. Capacity
 - d. Speed
 - e. Ratings
 - f. Additional pertinent information

1.05 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Deliver, store and handle products in accordance with the manufacturer's recommendations, using means and methods that will prevent damage, deteriorating and loss, including theft.
 - 1. Schedule delivery to minimize long-term storage at the 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 the site in the manufacturer's original sealed container of other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting and installing.
 - 4. Inspect products upon delivery to ensure compliance with the Contract Documents and to ensure that products are undamaged and properly

protected.

5. Store products at the site in a manner that will facilitate inspection and measurement of quantity or counting of units.
6. Store heavy materials away from the Project structure in a manner that will not endanger the supporting construction.
7. Store products subject to damage by the elements above ground, under cover in a weather tight enclosure, with ventilation adequate in prevent condensation. Maintain temperature and humidity within range required by manufacturer's instructions.

PART 2 PRODUCTS

2.01 PRODUCT SELECTION

- A. General Product Requirements: Provide products that comply with the Contract Documents, that are undamaged and, unless otherwise indicated, unused at the time of installation.
 1. Provide products complete with all accessories, trim, finish, safety guards and other devices and details needed for a complete installation and for the intended use and effect.
 2. Standard Products: Where available, provide standard products of types that have been produced and used successfully in similar situation on other projects.
- B. Product Selection Procedures: Product selection is governed by the Contract Documents and governing regulations, not by previous project experience. Procedures governing product selection include the following:
 1. Proprietary Specification Requirements: Where only a single product or manufacturer is named, provide the product indicated. No substitutions will be permitted.
 - a. Where products or manufacturers are specified by name, accompanied by the term 'or equal' or 'or approved equal' comply with the Contractor Document provisions concerning 'substitutions' to obtain approval for use of an unnamed product.
 2. Non-Proprietary Specifications: When the Specifications list products or manufacturers that are available and may be incorporated in the Work, but do not restrict the Contractor to use of those products only, the Contractor may propose any available product that complies with Contract requirements. Comply with Contract Document provisions concerning 'substitutions' to obtain approval for use of an unnamed product.
 3. Descriptive Specification Requirements: Where Specifications describe a product or assembly, listing exact characteristics required, with or without

use of a brand or trade name, provide a product or assembly that provides the characteristics and otherwise complies with Contract requirements.

4. Performance Specification Requirements: Where Specifications require compliance with performance requirements, provide products that comply with these requirements, and are recommended by the manufacturer for the application indicated.
 - a. Manufacturer's recommendations may be contained in published product literature, or by the manufacturer's certification of performance.
5. Compliance with Standards, Codes and Regulations: Where the Specifications only require compliance with an imposed code, standard or regulation, select a product that complies with the standards, codes or regulations specified.
6. Visual Matching: Where Specifications require matching an established Sample, the Architect's decision will be final on whether a proposed product matches satisfactorily.
 - a. Where no product available within the specified category matches satisfactorily and also complies with other specified requirements, comply with provisions of the Contract Documents concerning 'substitutions' for selection of a matching product in another product category, or for noncompliance with specified requirements.
7. Visual Selection: Where specified product requirements include the phrase A... as selected from manufacturer's standard colors, pattern, textures... or a similar phrase, select a product and manufacturer that complies with other specified requirements. The Architect will select the color, pattern and texture from the product line selected.
8. Asbestos free materials: No products containing asbestos shall be used for any part of the work for this product. Provide verification.

PART 3 EXECUTION

3.01 INSTALLATION OF PRODUCTS

- A. Comply with manufacturer's instructions and recommendations for installation of products in the applications indicated. Anchor each project securely in place, accurately located and aligned with other work.
 1. Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.

END OF SECTION 01600

SECTION 01631
PRODUCTS SUBSTITUTIONS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. This Section specifies administrative and procedural requirements for handling request for substitutions.
- B. The Contractor's Installation Schedule and the Schedule of Submittals are included under Section Submittals.
- C. Standards: Refer to Section 01095 Reference Standards and Definitions for applicability of industry standards to products specified.
- D. Procedural requirements governing the Contractor's selection of products and product options are included under Section Materials and Equipment.

1.03 DEFINITIONS

- A. Definitions used in this Article are not intended to change or modify the meaning of other terms used in the Contract Documents.
- B. Substitutions: Requests for changes in products, materials, equipment, and methods of installation required by Contract Documents proposed by the Contractor after award of the Contract are considered requests for substitutions. The following are not considered substitutions:
 - 1. Only substitutions requested by Contractor are considered as included in the Contract Documents and are not subject to requirements specified in Section for substitutions.
 - 2. Revisions to Contract Documents requested by the Owner or Architect.
 - 3. Specified options of products and installation methods included in Contract Documents.
 - 4. The Contractor's determination of and compliance with governing regulations and orders issued by governing authorities.

1.04 SUBMITTALS

- A. Substitution Request Submittal: Request for substitution will be considered if received within thirty (30) days after commencement of the Work, as long as this time allowance will not impact the construction schedule,

1. Submit three (3) copies of each request for substitution for consideration. Submit requests in the form and in accordance with procedures required for Change Order proposals.
2. Identify the product, or the fabrication or installation method to be replaced in each request. Include related Specification Section and Drawing numbers. Provide complete documentation showing compliance with the requirements for substitution, and the following information, as appropriate:
 - a. Product Data, including Drawings, and descriptions of products, fabrication and installation procedures.
 - b. Samples, where applicable or requested.
 - c. A detailed comparison of significant qualities of the proposed substitution with those of the Work specified. Significant qualities may include elements such as size, weight, durability, performance and visual effect.
 - d. Coordination information, including a list of changes or modifications needed to other parts of the Work and to construction performed by the Owner and separate Contractor's, that will become necessary to accommodate the proposed substitution.
 - e. A statement indicating the substitution's effect on the Contractor's construction schedule compared to the schedule without approval of the substitution. Indicate the effect of the proposed substitution on overall Contract Time.
 - f. Cost information, including a proposal of the net change, if any in the Contract Sum.
 - g. Certification by the Contractor that the Substitution proposed is equal-to or better in every significant respect to that required by the Contract Documents, and that it will perform adequately in the application indicated. Include the contractor's waiver of rights to additional payment or time, that may subsequently become necessary because of the failure of the substitution to perform adequately.
3. Architects Action: Within two weeks of receipt of the request for substitution, the Architect will request additional information or documentation necessary for evaluation of the request if needed. Within two (2) weeks of receipt of the request, or one week of receipt of the additional information or documentation, which ever is later, the Architect will notify the Contractor of acceptance or rejection of the proposed substitution. If a decision on use of a proposed substitute cannot be made or obtained within the time allocated, use the project specified by name. Decision on the use of a product substitution or its rejection by the Architect is considered final. Acceptance will be in the form of a Change Order.

PART 2 PRODUCTS

2.01 SUBSTITUTIONS

- A. Conditions: The Contractor's substitution request will be received and considered by the Architect when one or more of the following conditions are satisfied, as

determined by the Architect; otherwise request will be returned without action except to record noncompliance with these requirements.

1. Extensive revisions to Contract Documents are not required.
 2. Proposed changes are in keeping with the general intent of Contract Documents.
 3. The request is timely, fully documented and properly submitted.
 4. The specified product or method of construction cannot be provided within the Contract Time. The request will not be considered if the product or method cannot be provided as a result of failure to pursue the work promptly or coordinate activities properly.
 5. The specified product or method of construction cannot receive necessary approval by a governing authority, and the requested substitution can be approved.
 6. A substantial advantage is offered to the Owner, in terms of cost, time, energy conservation or other considerations of merit, after deducting offsetting responsibilities the Owner may be required to bear. Additional responsibilities for the Owner may include additional compensation to the Architect for redesign and evaluation services, increased cost of other construction by the Owner or separate Contractors, and similar consideration.
 7. The specified product or method of construction cannot be provided in a manner that is compatible with other materials, and where the Contractor certifies that the substitution will overcome the incompatibility.
 8. The specified product or method of construction cannot be coordinated with other materials, and where the Contractor certifies that the proposed substitution can be coordinated.
 9. The specified product or method of construction cannot provide a warranty required by the Contract Documents and where the Contractor certifies that the proposed substitution provide the required warranty.
- B. The Contractor's submittal and Project Manager's acceptance of Shop Drawings, Product Data or Samples that relate to construction activities not complying with the Contract Documents does not constitute an acceptable or valid request for substitution, nor does it constitute approval.
- C. Substitution request constitutes a representation that the Contractor:
1. Has investigated proposed product and determined that it meets or exceeds, in all respects, specified product.
 2. Will provide the same warranty for substitution as for specified product.

3. Will coordinate installation and make other changes which may be required for work to be complete in all respects.
4. Waives claims for additional costs which may subsequently become apparent. All costs associated with the substitution will be paid by the Contractor regardless of approvals given, and regardless of subsequent difficulties experienced as a result of substitutions.

END OF SECTION 01631

SECTION 01700
PROJECT CLOSE-OUT

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. This Section specifies administrative and procedural requirements for project close-out, including but not limited to:
1. Inspection procedures
 2. Project record document submittal. (Substantial Completion requirements)
 3. Operating and Maintenance Manual Submittal (Substantial Completion requirements).
 4. Submittal of warranties (Substantial Completion requirement).
 5. Final cleaning
- B. Close-out requirements for specific construction activities are included in the appropriate Sections in Divisions 2 through 49.
- C. Final Payment to be made when the County has received all required close-out documents.

1.03 SUBSTANTIAL COMPLETION

- A. Preliminary Procedures: Before requesting inspection for Certification of Substantial Completion, complete the following: List exceptions in the request.
1. In the Application for Payment that coincided with, or first follows, the date Substantial Completion is claimed, show 100 percent completion for the portion of the Work claimed as substantially complete. Include supporting documentation for completion as indicated in these Contract Documents and a statement showing an accounting of changes to the Contract Sum.
 - a. If 100 percent completion cannot be shown, include a list of incomplete items, the value of incomplete construction, and reasons the work is not complete.
 2. Advise Owner of pending insurance change-over requirements.
 3. Submit specific warranties, workmanship bonds, maintenance agreements, final certifications and similar documents.
 4. Obtain and submit releases enabling the Owner unrestricted use of the work and access to services and utilities; include occupancy permits, operating certificates and similar releases.

5. Complete final clean up requirements, including touch-up painting. Touch-up and otherwise repair and restore marred exposed finishes.
- B. Inspection Procedures: On receipt of a request for inspection, the Project Manager will either proceed with inspection or advise the Contractor of unfilled requirements. The Project Manager will prepare the Certificate of Substantial Completion following inspection, or advise the Contractor of construction that must be completed or corrected before the certificate will be issued.
1. Results of the completed inspection will form the basis of requirements for final acceptance.
 2. Should the project fail to meet the standards required for Substantial Completion as defined in the documents, the Contractor will pay the expense of a second inspection by the Architect/Consultants and the Owner. Cost will be deducted from the Contractor's retainage.

1.04 FINAL ACCEPTANCE

- A. Preliminary Procedures: Before requesting final inspection for certification of final acceptance and final payment, complete the following list exceptions in the request:
1. Submit the final payment request with releases and supporting documentation not previously submitted and accepted. Include certificates of insurance for products and complete operations where required.
 2. Submit an updated final statement, accounting for final additional changes to the Contract Sum.
 3. Submit a certified copy of the Architect or Owner's final inspection list of items to be completed or corrected, stating that each item has been completed or otherwise resolved for acceptance, and the list has been endorsed and dated by the Project Manager.
 4. Submit final meter readings for utilities, a measured record of stored fuel and similar data as of the date of Substantial Completion, or when the Owner took possession of the responsibility for corresponding elements of the Work.
 5. Submit consent of surety to final payment.
 6. Submit a final liquidated damages settlement statement
 7. Submit evidence of final, continuing insurance coverage complying with insurance requirements.
- B. Reinspection Procedure: The Architect will reinspect the work upon receipt of notice that the work, including inspection list items from earlier inspections, has been completed, except items whose completion has been delayed because of circumstances acceptable to the Architect.

1. Upon completion of reinspection, the Architect will prepare a certification of final acceptance, or advise the contractor of work that is incomplete or of obligations that have not been fulfilled but are required for final acceptance.

1.05 RECORD DOCUMENT SUBMITTALS

- A. General: Do not use record documents for construction purposes; protect from deterioration and loss in a secure, fire-resistive location; provide access to record documents for the Architect's reference during normal working hours.
- B. Record Drawings: Maintain a clean, undamaged set of blue or black line white-prints of Contract Drawings and Shop Drawings. Mark the set to show the actual installation; where the installation varies substantially from the work as originally shown. Mark whichever drawing is most capable of showing conditions fully and accurately; where Shop Drawings are used, record a cross-reference at the corresponding location on the Contract Drawings. Give particular attention to concealed elements that would be difficult to measure and record at a later date. Provide for project photographs if deemed necessary by Owner's representative.
 1. Mark record sets with red erasable pencil; use other colors to distinguish between variations in separate categories of the work.
 2. Mark new information that is important to the Owner, but was not shown on Contract Drawings or Shop Drawings.
 3. Note related Change Order numbers where applicable.
 4. Organize record drawing sheets, and print suitable titles, dates and other identification on the cover of each set.
 5. Provide three (3) additional sets of black line drawing sets of As-Builts Drawings.
- C. Record Specifications: Maintain one complete copy of the Project Manual, including addenda, and one copy of other written construction documents such as Change Orders and modifications issued in printed form during construction. Mark these documents to show substantial variations in actual work performed in comparison with the text of the specifications and modifications. Give particular attention to substitutions, selection of options and similar information on elements that are concealed or cannot otherwise be readily discerned later by direct observation. Note related record drawing information and Project Data.
 1. Upon completion of the Work, submit record Specifications to the Architect for the Owner's records.
- D. Record Project Data: Maintain one copy of each Product Data submittal. Mark these documents to show significant variation in actual work performed in comparison with information submitted. Include variations in products delivered to the site, and from the manufacturer's installation instructions and recommendations. Give particular attention to concealed products and portions of the Work which

cannot otherwise be readily discerned later by direct observation. Note related Change Orders and mark-up of record drawings and Specifications.

1. Upon completion of mark-up, submit complete set of record Product Data in the three ring binder (indexed) to the Architect for the Owners records.
- E. Record Sample Submitted: Immediately prior to the date or dates of substantial completion, the Contractor will meet at the site with the Architect and the Owners personnel to determine which of the submitted Samples that have been maintained during progress of the work are to be transmitted to the Owner for record purposes. Comply with delivery to the Owners Sample storage area.
- F. Miscellaneous Record Submittals: Refer to other Specification Sections for requirements of miscellaneous record-keeping and submittals in connection with actual performance of the work. Immediately prior to the date or dates of substantial completion, complete miscellaneous record and place in good order, properly identified and bound or filed, ready for continued use and reference. Submit to the Project Manager for the Owner's records.
- G. Maintenance Manuals: Organize operating and maintenance data into five (5) suitable sets of manageable size. Bind properly indexed data in individual heavy-duty 2-inch, 3-ring vinyl covered binders, with pocket folders for folded sheet information. Mark appropriate identification on front and spine of each binder. Include the following types of information:
1. Emergency instructions
 2. Spare parts list
 3. Copies of warranties
 4. Wiring diagrams
 5. Recommended turn-around cycles
 6. Inspection procedures
 7. Shop Drawings and Product Data
 8. Fixture lamping schedule

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION

3.01 CLOSE-OUT PROCEDURES

- A. Operating and Maintenance Instructions: Arrange for each installer of equipment that required regular maintenance. If installers are not experienced in procedures, provide instruction by manufacturer's representatives. All items to be provided or competed prior to Certificate of Substantial Completion being issued by the Owner. Include a detailed review of the following items:
1. Maintenance manuals
 2. Record documents
 3. Spare parts and materials
 4. Tools
 5. Lubricants

6. Fuels
7. Identification systems
8. Control sequences
9. Hazards
10. Cleaning
11. Warranties and bonds
12. Maintenance agreements and similar continuing commitments
13. On site instructions to County maintenance personnel on major systems operations such as HVAC as per technical specifications.

B. As part of instruction for operating equipment, demonstrate the following procedures, prior to the Owner issuing Certificate of Substantial Completion:

1. Start-up
2. Shutdown
3. Emergency operations
4. Noise and vibration adjustments
5. Safety procedures
6. Economy and efficiency adjustments

3.02 PROJECT CLOSE-OUT MANUALS AT SUBSTANTIAL COMPLETION

A. Submit Project Close-out Manuals prior to issuance of final application for payment. Provide three (3) copies.

B. Bind in commercial quality 8.5 x 11" three ring binder, indexed with hardback, cleanable, plastic covers.

C. Label cover of each binder with typed title PROJECT CLOSE-OUT MANUAL, with title of project; name, address, and telephone number of Contractor and name of responsible Principal.

D. Provide table of contents: Neatly typed, in the following sequence:

1. Final Certificate of Occupancy
2. Warranty Service Subcontractors Identification List
3. Final Lien Waivers and Releases
4. Warranties and Guarantees
5. Systems Operations and Maintenance Instruction
6. Manufacturer's Certificates and Certifications
7. Maintenance Service Contracts
8. Spare Parts Inventory List
9. Special Systems Operating Permits or Approvals
10. Asbestos free materials notarized statement

E. Provide all documents for each section listed. List individual documents in each section in the Table of Contents, in the sequence of the Table of Contents of the Project Manual.

F. Identify each document listed in the Table of Contents with the number and title of the specification section in which specified, and the name of the product or work

item.

- G. Separate each section with index to sheets that are keyed to the Table of Contents listing.
- H. Warranty Service Subcontractors List shall identify subcontractor supplier, and manufacturer for each warranty with name, address and emergency telephone number.
- I. Electronic Close-out DVD: At the completion of the project, submit one copy of a DVD with entire project close out information below in PDF format. All letter, legal and brochure size sheets shall be portrait and the As-build drawings will be landscape. All fonts will be Arial. All items will be in PDF with OCR (Optical Character Recognition). This will enable a search engine to identify words on the scanned documents.
 - 1. Contacts: Set up a separate PDF for the contacts. No bookmarks are needed for this section.
 - 2. As-Built: All as-built drawings will be landscape.
 - 3. Submittals: All technical submittal items (approved and approved as noted) will be provided and sorted by the 16 standard divisions. Bookmarks will be needed for the appropriate divisions.
 - 4. Operations and Maintenance Manual: Specify the division name only in the bookmarks (1-16). Please note that all items will be in PDF with OCR (Optical Character Recognition). This will enable a search engine to identify works on the scanned documents.
 - 5. Permitting: This should include the Certificate of Occupancy and any other document that the Project Manager may include pertaining to the permitting for the project.

3.03 FINAL CLEANING

- A. General: General cleaning during construction is required by the General Conditions and included in Section - Temporary Facilities.
- B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to the condition expected in a normal, commercial building cleaning and maintenance program. Comply with manufacturer's instructions.
 - 1. Complete the following cleaning operations before requesting inspection for Certification of Substantial Completion.
 - a. Remove labels that are not permanent labels.
 - b. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compound and other substances that are noticeable vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials.
 - c. Clean exposed exterior and interior hard-surfaced finished to a dust-free condition, free of stains, films and similar foreign substances. Restore reflective surfaces to their original reflective condition.

- Leave concrete floors broom clean. Vacuum carpeted surfaces.
- d. Wipe surfaces of mechanical and electrical equipment. Remove excess lubrication and other substances. Clean plumbing fixtures to a sanitary condition. Clean light fixtures and lamps.
 - e. Clean the site, including landscape development areas, of rubbish, litter and other foreign substances. Sweep paved areas broom clean; remove stains, spills and other foreign deposits. Rake grounds that are neither paved nor planted, to a smooth even-textured surface. Remove waste and surplus materials from the site in an appropriate manner.
- C. Pest Control: Engage an experienced exterminator to make a final inspection, and rid the Project of rodents, insects and other pests.
- D. Removal of Protection: Remove temporary protection and facilities installed for protection of the work during construction.
- E. Compliance: Comply with regulations of authorities having jurisdiction and safety standards for cleaning. Do not burn waste materials. Do not bury debris or excess materials on the Owner's property. Do not discharge volatile, harmful or dangerous materials into drainage systems. Remove waste materials from the site and dispose of in a lawful manner.
1. Where extra materials of value remaining after completion of associated work have become the Owner's property, arrange for disposition of these materials as directed.

END OF SECTION 01700

SECTION 01740
WARRANTIES AND BONDS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. This Section specifies general administrative and procedural requirements for warranties and bonds required by the Contractor Documents, including manufacturer's standard warranties on products and special warranties.
 - 1. Refer to the General Conditions for terms of the Contractors special warranty of workmanship and materials.
 - 2. General close-out requirements are included in Section 01700 Project Close-Out.
 - 3. Specific requirements for warranties for the work and products and installations that are specified to be warranted, are included in the individual Sections of Division 2 through 49.
 - 4. Certifications and other commitments and agreements for continuing services to Owner are specified elsewhere in the Contract Documents.
- B. Disclaimers and Limitations: Manufacturers' disclaimers and limitations on product warranties to not relieve the Contractor of the warranty on the work that incorporates the products, nor does it relieve suppliers, manufacturers, and subcontractors required to countersign special warranties with the Contractor.

1.03 WARRANTY REQUIREMENTS

- A. Related Damages and Losses: When correcting warranted work that has failed, remove and replace other work that has been damaged as a result of such failure or that must be removed and replaced to provide access for correction of warranted work.
- B. Reinstatement of Warranty. When work covered by a warranty has failed and been corrected by replacement or rebuilding, reinstate the warranty by written endorsement. The reinstated warranty shall be equal to the original warranty with an equitable adjustment for depreciation.
- C. Replacement Cost: Upon determination that work covered by a warranty has failed, replace or rebuild the work to an acceptable condition complying with requirements of Contract Documents.
- D. Owners Recourse: Written warranties made to the Owner are in addition to implied

warranties, and shall not limit the duties, obligation, rights and remedies otherwise available under the law, nor shall warranty periods be interpreted as limitations on time in which the Owner can enforce such other duties, obligation, rights, or remedies.

1. Rejection of Warranties: The Owner reserves the right to reject warranties and to limit selections to products with warranties not in conflict with requirements of the Contract Documents.
- E. The Owner reserves the right to refuse to accept work for the Project where a special warranty, certification, or similar commitment is required on such work or part of the Work, until evidence is presented that entities required to countersign such commitments are willing to do so.

1.04 WARRANTY PERIOD

- A. The Contractor shall participate with the County and the Architects' representative, at the beginning of the tenth month of the warranty period, in conducting an on site review and evaluation of all items of equipment, materials and workmanship covered by the warranties and guarantees. Contractor shall act promptly and without cost to the County to correct all defects, problems, or deficiencies determined as such by the Architect/Owner during on the site review.
- B. All warranties and guarantees shall commence on the date of Substantial Completion except for items which are determined by the County to be incomplete or a non-comply status at the time of Substantial Completion. The coverage commencement date for warranties and guarantees of such work shall be the date of the County's acceptance of that work.
- C. Warranty period shall be manufacturers standard for product specified except where specific warranty periods are specified in individual sections. But in no case less than one year.

1.05 SUBMITTALS

- A. Submit written warranties to the Owner prior to the date certified for Substantial Completion. If the Architect's Certificate of substantial Completion designates a commencement date for warranties other than the date of Substantial Completion for the Work, or a designated portion of the work, submit written warranties upon request of the Project Manager.
1. When a designated portion of the work is completed and occupied or used by the Owner, by separate agreement with the Contractor during the construction period, submit properly executed warranties to the Project Manager within fifteen days of completion of that designated portion of the work.
- B. When a special warranty is required to be executed by the Contractor, or the Contractor and a subcontractor, supplier or manufacturer, prepared a written document that contains appropriate terms and identification, ready for executing by the required parties. Submit a draft to the Architect for approval prior to final

execution.

1. Refer to individual Sections of Division 2 through 49 for specific content requirements, and particular requirements for submittal of special warranties.
- C. Form of Submittal: At Final Completion compile two (2) copies of each required warranty and bond properly executed by the Contractor, or by the Contractor, subcontractor, supplier, or manufacturer. Organize the warranty documents into an orderly sequence based on the table of contents of the Project Manual.
- D. Bind (3) three sets of warranties and bonds in heavy-duty, commercial quality, durable 3-ring vinyl covered loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8 ½ by 11" paper.
1. Provide heavy paper dividers with Celluloid covered tabs for each separate warranty. Mark the 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 the installer.
 2. Identify each binder on the front and the spine with the typed or printed title "WARRANTIES AND BONDS", the Project title or name, and the name of the Contractor.
 3. When operating and maintenance manuals are required for warranted construction, provide additional copies of each required warranty, as necessary, for inclusion in each required manual.

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION (Not Applicable)

END OF SECTION 01740

SECTION 02110 - SITE CLEARING

PART 1 - GENERAL

1.01 SCOPE OF WORK:

Site clearing work includes, but is not limited to:

Removal of trees and other vegetation.
Topsoil stripping.
Clearing and grubbing.
Removing above grade improvements.
Removing below grade improvements.

1.02 RELATED SECTIONS:

Section 02200 - Earthwork

1.03 JOB 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 protection necessary to prevent damage to existing improvements indicated to remain in place.

Protect bench marks and existing work from damage or displacement.

Protect improvements on adjoining properties and on Owner's property.

Restore damaged improvements to original condition as acceptable to parties having jurisdiction.

C. Regulatory Requirements:

Conform to applicable local code for disposal of debris.

1.04 EROSION CONTROL:

Whether otherwise shown on the plans or not, provide adequate protection to eliminate contamination of streams, canals, lakes, reservoirs and other impoundments by oil, fuels, bitumen, calcium chloride or other harmful materials. Take positive steps to minimize erosion and resultant siltation.

Where air pollution is a factor water the haul roads and construction areas to help reduce the dust.

Where soil or other materials from the work area have been allowed, for whatever reason, to enter public lands, roads or streams, the Contractor shall remove the materials and repair any damage to the public facility.

Permanent erosion control features shall be installed as early as possible. Do not expose large areas of erodible earth at any one time and make every effort to protect against such erosion.

PART 2 - PRODUCTS

2.01 MATERIALS:

A. Topsoil:

Sandy clay surface soil found in depth of not less than 6". Satisfactory topsoil is reasonably free of subsoil, clay lumps, stones, and other objects over 2" in diameter, and without weeds, roots, and other objectionable material.

PART 3 - EXECUTION

3.01 SITE CLEARING:

Remove trees, shrubs, grass, other vegetation, improvements, or obstructions interfering with installation of new construction.

Remove items elsewhere on site or premises as specifically indicated. Removal includes digging out stumps and roots.

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

Stockpile topsoil in storage piles in areas shown or where directed. Construct storage piles to freely drain surface water. Cover storage piles if required to prevent windblown dust.

Dispose of unsuitable or excess topsoil same as specified for waste material.

3.02 Clearing and Grubbing:

The trees selected by the Project Engineer for saving shall be protected from construction equipment by the Contractor in a manner approved by the Project Engineer and meeting the criteria for such protection as required by the applicable governmental agency.

Clear site of trees, shrubs, and other vegetation.

Completely remove stumps, roots, and other debris protruding through ground surface.

Fill depressions caused by clearing and grubbing operations with satisfactory soil material, unless further excavation or earthwork is indicated.

Place fill material in horizontal layers not exceeding 6" loose depth, and thoroughly compact to density equal to adjacent original ground, unless otherwise shown on the plans.

3.03 Removal of Improvements: Remove existing above grade and below grade improvements necessary to permit construction and other work.

Remove abandoned underground piping or conduit interfering with construction.

3.04 DISPOSAL OF WASTE MATERIALS:

Removal from Owner's Property: Remove waste materials and unsuitable and excess topsoil from Owner's property and dispose of off-site in legal manner.

END OF SECTION

SECTION 02200 - EARTHWORK

PART 1 - GENERAL

1.01 SCOPE OF WORK:

Provide all labor, tools, materials, equipment and supervision necessary for excavation and site grading as specified herein.

1.02 RELATED WORK:

Section 02110 – Site Clearing

1.03 STANDARDS:

Comply with state and local environmental standards and as specified herein.

1.04 EARTHWORK:

Borrow material to be used for fill shall be tested for radon level. The contractor shall collect three samples of material at the borrow pit and submit them to a certified laboratory for testing. Radon levels shall not exceed 2pCi/g. The contractor shall submit certifications to the architect showing that the borrow material meets this criteria before bringing any material to the project site.

PART 2 - PRODUCTS

NOT USED

PART 3 - EXECUTION

3.01 EXCAVATION:

Excavation shall conform to the limits indicated on the plans or specified herein. This work shall include shaping and sloping and other work necessary in bringing the excavation to the required grade, alignment and cross section.

All suitable materials removed by the excavation shall be used as far as practicable in the formation of the embankments, subgrades, shoulders, and other places as directed. No excavated material shall be wasted without permission, and where necessary to waste such material, it shall be disposed of as directed by the Owner. Waste excavated material shall be considered property of the Owner and disposed of as directed by the Owner.

3.02 AREA EXCAVATION:

The area of excavation shall be as indicated on the construction plans.

3.03 FILLING AND COMPACTING:

Replace excavated material as necessary. Place fill in layers and compact to a minimum density at optimum moisture as required.

3.04 EMBANKMENT:

Embankments shall be constructed of material containing no muck, stumps, roots, brush, vegetable matter, rubbish or other material that will not compact into a stable finished grade surface.

Embankments shall be formed of suitable material placed in layers of not more than 8 inches in depth measured loose and rolled and/or vibrated with suitable equipment until compacted. Each layer shall be uniformly compacted, using equipment that will achieve the required density. As compaction operations progress, each layer shall be shaped and manipulated as necessary to assure density throughout the embankment or backfill. Moisture content shall be such that the specified density can be reached and, if necessary, water shall be added or the material manipulated to assist drying. Thickness of layers may be increased provided the equipment and methods used are proven by field density testing to be capable of compacting thicker layers to specified densities. Layer thickness shall be decreased if equipment and methods used are proven to be incapable of compacting layers to specified densities.

Embankment on building sites, shall be compacted to a density of not less than 100 percent of its maximum density as determined by AASHTO T 99, Method C.

The bottoms of the drainage retention areas shall not be compacted so as to not reduce the soil infiltration capacity.

Final earthwork elevations shall be within 0.2 feet of the proposed elevations.

3.05 MAINTENANCE AND PROTECTION OF WORK:

The Contractor shall maintain all earthwork construction throughout the life of the contract, unless otherwise provided, and shall take all reasonable precautions to prevent loss of material from the site due to the action of wind or water. He shall repair at his expense, except as otherwise provided herein, any slides, washouts, settlement, subsidence, or other mishap which may occur prior to final acceptance of work.

3.06 FINAL DRESSING:

Before final acceptance, the Contractor shall dress all earthwork to the planned line, grade and cross section. Ditches shall be shaped so that no water is impounded, unless otherwise shown on the plans. Earthwork shall be shaped to match adjacent grades, structures, etc.

3.07 SUBGRADE STABILIZATION

Methods of Subgrade Stabilization: Subgrade shall be stabilized by either: (i) addition of approved materials to the existing subgrade, or (ii) manipulating materials already in existence in the subgrade to achieve the desired results. It is the intent of this Specification that the subgrade be uniform, compact, capable of carrying reasonable loads, meet the required density and the required bearing value specified in the plans and/or these Specifications.

Mixing and Compacting: Additive materials shall be spread uniformly over the entire surface to be stabilized using a mechanical spreader, for a length that will provide sufficient distance to promote uniform mixing. A spreading tolerance of three inches (3) in excess of plan width will be tolerated on each side.

Mixing shall be done, with rotary tillers, or other equipment meeting the Engineer's approval, for the full depth shown in the plans, and for the full width of the stabilizing limits.

The Contractor may, if he so elects, mix the materials in a plant of an approved type in lieu of the spreading and mixing operation described above.

Where the subgrade is of rock, the Engineer shall determine whether or not it is necessary to undercut and stabilize the subgrade and, if he determines the rock subgrade is extensive enough in nature to waive the requirement for subgrade stabilization, he shall so notify the Contractor in writing.

At the completion of the mixing any particles within the limits of the stabilizing area not passing a three and one half inch (3 1/2") sieve shall be removed or broken down.

After mixing has been completed and requirements for bearing value, uniformity and particle size have been satisfied, the stabilized area shall be compacted to at least 96 percent of its maximum density as determined by AASHTO T180. If the moisture content of the material is improper for attaining the specified density, either water shall be added or the material permitted to dry to the proper moisture.

Spreading, mixing and compacting shall be done as one lift unless otherwise specified in the plans.

After stabilizing and compacting operations have been completed the subgrade shall be firm and substantially unyielding, to the extent it will support construction equipment, and will have the bearing value required by the plans. All soft and unyielding material and any other portions of the

subgrade which will not compact readily shall be removed and replaced with suitable material and the whole subgrade brought to line and grade, with proper allowance for subsequent compaction.

Maintenance of Completed Subgrade: The Contractor shall be wholly responsible for maintaining the completed subgrade free from ruts, depressions, damage from hauling or handling of materials, tools and equipment. Such responsibility shall include any repairs, replacements, etc. of curbs, curb and gutter, sidewalks or other structures which might become necessary in order to recompact the subgrade in the event of underwash or other damage occurring to the previously compacted subgrade. The subgrade shall be restored to an acceptable condition prior to placement of base.

Tolerances in Bearing Value Requirements: The following under-tolerances from the specified bearing value will be allowed as based on tests performed on samples obtained after mixing operations have been complete:

SPECIFIED LIMEROCK BEARING RATION	MAXIMUM PERMITTED UNDER TOLERANCE
LBR 40	5.0
LBR 35	4.0
LBR 30 or Under	2.5

Local Materials:

Local materials used for stabilizing may be high bearing value soils or sand-clay materials. The portion of the material passing the 40 mesh sieve shall have a liquid limit not greater than 30 and a plasticity index not greater than ten (10). Local materials, may, if so approved by the Engineer, be blended to achieve the above requirements but, if so blended shall be tested and approved before spreading on the roadway.

Commercial Materials:

Commercial materials used for stabilization may consist of commercial limerock, lime-rock overburden or crushed shell. For limerock and limerock overburden the percentage of carbonates of calcium and magnesium shall be at least 70, and the plasticity index shall not exceed ten (10). The gradation of limerock and limerock overburden shall be such that 97 percent of the material will pass a one inch (1") sieve.

Crushed shell for this use shall be mollusk shell (oyster, mussels, clams, cemented coquina, etc.). Steamed shell shall not be permitted. At least 97 percent by weight of the crushed shell shall pass the three and one-half inch (3 1/2") sieve and at least 50 percent by weight of the total material shall be retained in the No. 4 sieve. In addition, no more than 15 percent by weight of the total material shall pass the No. 200 sieve when washed over the sieve. In the event the shell meets the above criteria without crushing, the crushing will not be required.

END OF SECTION

SECTION 02220 - EXCAVATING, BACKFILLING, AND COMPACTING

PART 1 - GENERAL

1.01 DESCRIPTION

A. Scope of Work: The work included under this Section consists of excavating, backfilling and compacting as required for the construction of the utility system consisting of piping and appurtenances as shown on the Drawings and specified herein.

B. Definitions:

1. Maximum Density: Maximum weight in pounds per cubic foot of a specific material.

2. Optimum Moisture: Percentage of water in a specific material at maximum density.

3. Rock Excavation: Excavation of any hard natural substance which requires the use of explosives and/or special impact tools such as jack hammers, sledges, chisels or similar devices specifically designed for use in cutting or breaking rock, but exclusive of trench excavating machinery.

4. Suitable: Suitable materials for fills shall be a noncohesive, nonplastic granular local sand and shall be free from vegetation, organic material, marl, silt or muck. The Contractor shall furnish all additional fill material required.

5. Unsuitable: Unsuitable materials are highly organic soil (Peat or muck) classified as A-8 in accordance with AASHTO Designation M 145.

C. Plan For Earthwork: The Contractor shall be responsible for having determined to his satisfaction, prior to the submission of his bid, the conformation of the ground, the character and quality of the substrata, the types and quantities of materials to be encountered, the nature of the groundwater conditions, the prosecution of the work, the general and local conditions and all other matters which can in any way affect the work under this Contract. Prior to commencing the excavation, the Contractor shall submit a plan of his proposed operations to the Engineer for review. The Contractor shall consider, and his plan for excavation shall reflect, the equipment and methods to be employed in the excavation. The prices established in the Proposal for the work to be done will reflect all costs pertaining to the work.

1.02 QUALITY ASSURANCE

A. A testing laboratory employed by the Owner will make such tests as are deemed advisable. The Contractor shall schedule his work so as to permit a reasonable time for

testing before placing succeeding lifts and shall keep the laboratory informed of his progress. Costs for all testing shall be paid by the Owner. However, any and all tests which have to be repeated because of the failure of the tested material to meet specification shall be paid for by the Contractor and the cost of any tests shall be deducted from payments due the Contractor.

B. Standards:

1. OSHA 29 CFR Subpart P - Excavations and Trenches a) 1926.650, 1926.651, 1926.652.
2. OSHA 29 CFR Subpart J - a) 1910.146 for Confined Space Entry.

1.03 JOB CONDITIONS

A. Test borings made on the site and the surface exploration data are available upon request and are for the Contractor's information only.

B. If, in the opinion of the Engineer, conditions encountered during construction warrant a change in the footing elevation, or in the depth of removal of unsuitable material from that indicated on the Drawings, an adjustment will be made in the contract price, as provided in the Schedule of cost for Changes in Quantities.

1.04 PROTECTION

A. Sheeting and Bracing:

1. Furnish, put in place, and maintain such sheeting and bracing as may be required to support the sides of excavations, to prevent any movement which could in any way diminish the width of the excavation below that necessary for proper construction, and to protect adjacent structures, power poles, etc. from undermining, and to protect workers from hazardous conditions or other damage. Such support shall consist of braced steel sheet piling, braced wood lagging and soldier beams or other approved methods. If the Engineer/RPR is of the opinion that at any points sufficient or proper supports have not been provided, he may order additional supports put in at the expense of the Contractor, and compliance with such order shall not relieve or release the Contractor from his responsibility for the sufficiency of such supports. Care shall be taken to prevent voids outside of the sheeting, but if voids are formed, they shall be immediately filled and compacted. Where soil cannot be properly compacted to fill a void, lean concrete shall be used as backfill at no additional expense to the Owner.

2. The Contractor shall construct the sheeting outside the neat lines of the foundation unless indicated otherwise to the extent he deems it desirable for his method of operation. Sheeting shall be plumb and securely braced and tied in position. Sheeting and bracing shall be adequate to withstand all pressure to which the structure or trench

will be subjected. Any movement or bulging which may occur shall be corrected by the Contractor at his own expense so as to provide the necessary clearances and dimensions.

3. Where sheeting and bracing is required to support the sides of excavations for structures, the Contractor shall engage a Professional Geotechnical Engineer, registered in the State of Florida, to design the sheeting and bracing. The sheeting and bracing installed shall be in conformity with the design, and certification of this shall be provided by the Professional Engineer.

4. The installation of sheeting, particularly by driving or vibrating, may cause distress to existing structures. The Contractor shall evaluate the potential for such distress and, if necessary, take all precautions to prevent distress of existing structures because of sheeting installation.

5. The Contractor shall leave in place to be embedded in the backfill all sheeting and bracing not shown on the Drawings but which the Owner may direct him in writing to leave in place at any time during the progress of the work for the purpose of preventing injury to structures, utilities, or property, whether public or private. The Engineer/R.P.R. may direct that timber used for sheeting and bracing be cut off at any specified elevation.

6. All sheeting and bracing not left in place shall be carefully removed in such manner as not to endanger the construction or other structures, utilities, or property. All voids left or caused by withdrawal of sheeting shall be immediately refilled with sand by ramming with tools especially adapted to that purpose, or otherwise as may be directed by the Engineer/R.P.R.

7. The right of the Engineer/R.P.R. to order sheeting and bracing left in place shall not be construed as creating any obligation on his part to issue such orders, and his failure to exercise his right to do so shall not relieve the Contractor from liability for damages to persons or property occurring from or upon the work occasioned by negligence or otherwise, growing out of a failure on the part of the Contractor to leave in place sufficient sheeting and bracing to prevent any caving or moving of the ground.

8. No wood sheeting is to be withdrawn if driven below mid-diameter of any pipe, and under no circumstances shall any wood sheeting be cut off at a level lower than 1 foot above the top of any pipe.

B. Groundwater Observation Wells:

1. Prior to excavation, the Contractor shall install groundwater observation wells at locations to be approved by the Engineer adjacent to structures under construction for the purpose of measuring water levels during excavation. The observation well shall consist of a screen, casing and cap of approved size and material of construction. The observation well shall be placed in a 2-1/2-inch bore hole which shall be carried to an

elevation at least 2 feet below final bottom grade of structure. The annular space surrounding the intake point and the riser pipe shall be sealed in such a way as to prevent infiltration from surface water. The observation well shall be developed in such a manner as to insure proper indication of subsurface water levels adjacent to the well.

2. The Contractor shall be responsible for maintaining the observation wells and for observing and recording the elevation of groundwater in them until adjacent structure is completed and backfilled. Each observation well shall be observed and recorded daily. Measurements shall be supplied daily to the R.P.R. and Engineer. The Engineer may require that the observation wells reflect true groundwater levels by adding water to the well recording the drop in level from the time the water was added. A plugged observation well shall be redeveloped as necessary to indicate true groundwater levels.
3. Observation well shall be abandoned when directed by the Engineer/R.P.R. and in a manner acceptable to the Engineer.

C. Pumping and Drainage:

1. The Contractor shall at all times during construction provide and maintain proper equipment and facilities to remove all water entering excavations, and shall keep such excavations dry so as to obtain a satisfactory undisturbed subgrade foundation condition until the fills, structures or pipes to be built thereon have been completed to such extent that they will not be floated or otherwise damaged by allowing water levels to return to natural levels as stipulated in Section 02140. The Contractor shall engage a Professional Geotechnical Engineer registered in the State of Florida, to design the dewatering systems for all structures. The Contractor shall submit to the Engineer for review a plan for dewatering systems prior to commencing work. The dewatering system installed shall be in conformity with the overall construction plan, and certification of this shall be provided by the Professional Engineer. The Professional Engineer shall be required to monitor the performance of the dewatering systems during the progress of the work and require such modifications as may be required to assure that the systems are performing satisfactorily.
2. Dewatering shall at all times be conducted in such a manner as to preserve the undisturbed bearing capacity of the subgrade soils at proposed bottom of excavation and to preserve the integrity of adjacent structures. Well or sump installations shall be constructed with proper sand filters to prevent drawing of finer grained soil from the surrounding ground.
3. Water entering the excavation from surface runoff shall be collected in shallow ditches around the perimeter of the excavation, drained to sumps, and pumped from the excavation to maintain a bottom free from standing water.
4. The Contractor shall take all additional precautions to prevent uplift of any structure during construction.

5. The conveying of water in open ditches or trenches will not be allowed. Permission to use any storm sewers, or drains, for water disposal purposes shall be obtained from the authority having jurisdiction. Any requirements and costs for such use shall be the responsibility of the Contractor. However, the Contractor shall not cause flooding by overloading or blocking up the flow in the drainage facilities, and he shall leave the facilities unrestricted and as clean as originally found. Any damage to facilities shall be repaired or restored as directed by the Engineer or the authority having jurisdiction, at no cost to the Owner.
6. Floation shall be prevented by the Contractor by maintaining a positive and continuous operation of the dewatering system. The Contractor shall be fully responsible and liable for all damages which may result from failure of this system.
7. Removal of dewatering equipment shall be accomplished after the system is no longer required; the material and equipment constituting the system, shall be removed by the Contractor.
8. The Contractor shall take all necessary precautions to preclude the accidental discharge of fuel, oil, etc. in order to prevent adverse effects on groundwater quality.

PART 2 - PRODUCTS

2.01 MATERIALS

A. General:

1. All fill material shall be subject to the approval of the Engineer.
2. All fill material shall be free of organic material, trash, or other objectionable material. Excess or unsuitable material shall be removed from the job site by the Contractor.

B. Common Fill Material: Common fill shall be sand and shall not contain stones, rock, concrete or other rubble larger than two (2) inches in diameter. It shall have physical properties which allow it to be easily spread and compacted.

C. Structural Fill: Structural fill shall be reasonably well graded sand to gravelly sand having the following gradation:

<u>U.S. Sieve Size</u>	<u>Percent Passing By Weight</u>
1 - in.	100
No. 4	75-100
No. 40	15-80
No. 100	0-30

No. 200 0-12

D. Class 1 Soils*: Manufactured angular, granular material, 1/4 to 1 1/2 inches (6 to 4 mm) size, including materials having significance such as crushed stone or rock, broken coral, crushed slag, cinders, or crushed shells. Sieve analysis for crushed stone is given below separately.

Crushed Stone: Crushed stone shall consist of clean mineral aggregate free from clay, loam or organic matter, conforming with ASTM C33 stone size No. 89 and with particle size limits as follows:

<u>U.S. Sieve Size</u>	<u>Percent Passing By Weight</u>
1/2	100
3/8	90-100
No. 4	20-55
No. 8	5-30
No. 16	0-10
No. 50	0- 5

E. Class II Soils**:

1. GW: Well-graded gravels and gravel-sand mixtures, little or no fines. Fifty (50) percent or more retained on No. 4 sieve. More than 95 percent retained on No. 200 sieve. Clean.
2. GP: Poorly graded gravels and gravel-sand mixtures, little or no fines. Fifty (50) percent or more retained on No. 4 sieve. More than 95 percent retained on No. 200 sieve. Clean.
3. SW: Well-graded sands and gravelly sands, little or no fines. More than fifty (50) percent passes No. 4 sieve. More than 95 percent retained on No. 200 sieve. Clean.
4. SP: Poorly graded sands and gravelly sands, little or no fines. More than fifty (50) percent passes No. 4 sieve. More than 95 percent retained on No. 200 sieve. Clean.

* Soils defined as Class I materials are not defined in ASTM D2487.

** In accordance with ASTM D2487, less than 5 percent pass No. 200 sieve.

F. Coarse Sand: Sand shall consist of clean mineral aggregate with particle size limits as follows:

<u>U.S. Sieve Size</u>	<u>Percent Passing By Weight</u>
3/8 inch	100
No. 10	85-100
No. 40	20-40
No. 200	0-12

G. Other Material: All other material, not specifically described, but required for proper completion of the work shall be selected by the Contractor and approved by the Engineer.

PART 3 - EXECUTION

3.01 PREPARATION

A. Clearing:

1. The construction areas shall be cleared of all obstructions and vegetation including large roots and undergrowth, within 10 feet of the lines of the excavation.
2. Strip and stockpile topsoil on the site at the location to be determined by the Owner.

3.02 EXCAVATION

A. General: Excavations for roadways, structures and utilities must be carefully executed in order to avoid interruption of utility service.

B. Excavating for Roadways/Structures/Utilities:

1. Excavation shall be made to such dimensions as will give suitable room for building the foundations and the structures, for bracing and supporting, for pumping and draining, and for all other work required.
 - a. Excavation for precast or prefabricated structures shall be carried to an elevation 2 feet lower than the proposed outside bottom of the structure to provide space for the select backfill material. Prior to placing the select backfill, the excavation shall be measured by the Engineer to indicate to the satisfaction of the Owner that the excavation has been carried to the proper depth and is reasonably uniform over the area to be occupied by the structure.

- b. Excavation for structures constructed or cast in place in dewatered excavations shall be carried down to the bottom of the structure where dewatering methods are such that a dry excavation bottom is exposed and the naturally occurring material at this elevation leveled and left ready to receive construction. Material disturbed below the founding elevation in dewatered excavations shall be replaced with Class B concrete.
- c. Footings: Cast-in-place concrete footing sides shall be formed immediately after excavation. Forming for footing sides is specified elsewhere.
2. Immediately document the location, elevation, size, material type and function of all new subsurface installations, and utilities encountered during the course of construction.
3. Excavation equipment operators and other concerned parties shall be familiar with subsurface obstructions as shown on the Drawings and should anticipate the encounter of unknown obstructions during the course of the work.
4. Encounters with subsurface obstructions shall be hand excavated.
5. Excavation and dewatering shall be accomplished by methods which preserve the undisturbed state of subgrade soils. Subgrade soils which become soft, loose, "quick" or otherwise unsatisfactory for support of structures as a result of inadequate dewatering or other construction methods, shall be removed and replaced by crushed stone as required by the Engineer/R.P.R. at the Contractor's expense.
6. The bottom of excavations shall be rendered firm and dry before placing any structure. Excavated material not suitable for backfill shall be removed from the site and disposed of by the Contractor.
7. All pavements shall be cut prior to removal, with saws or approved power tools.
8. Excavated material shall be stockpiled in such a manner as to prevent nuisance conditions. Surface drainage shall not be hindered.
9. All locations and elevations as required herein must be permanently documented by the Contractor, on the Record Drawings prior to the Engineer's approval of the Application for Payment for that work.
10. When force main pipe is less than 10 feet from a water main, the depth of cover shall be increased to 5 feet or 18 inches below the water main, whichever is greater.

3.03 DRAINAGE

- A. The Contractor shall at all times during construction provide and maintain proper equipment and facilities to remove promptly and dispose of properly all water entering

excavations, and keep such excavations dry so as to obtain a satisfactory undisturbed subgrade foundation condition. The dewatering method used shall prevent disturbance of earth below grade.

B. All water pumped or drained from the work shall be disposed of in a suitable manner without undue interference with other work, without damage to surrounding property, and in accordance with pertinent rules and regulations.

C. No construction, including pipe laying, shall be allowed in water. No water shall be allowed to contact masonry or concrete within 24 hours after being placed. The Contractor shall constantly guard against damage due to water and take full responsibility for all damage resulting from his failure to do so.

D. The Contractor will be required at his expense to excavate below grade and refill with crushed stone (gradation 57 or 89) or other approved fill material if the Engineer determines that adequate dewatering has not been provided.

3.04 UNDERCUT

A. If the bottom of any excavation is below that shown on the Drawings or specified because of Contractor error, convenience, or unsuitable subgrade due the Contractor's excavation methods, he shall refill to normal grade with fill at his own cost. Fill material and compaction method shall be as directed by the Engineer.

3.05 FILL AND COMPACTION

A. Compact and backfill excavations and construct embankment according to the following schedule. (Proctor standard shall be ASTM D-698):

STRUCTURES AND ROADWORK

<u>Area</u>	<u>Material</u>	<u>Compaction</u>
Beneath Structures	Structural Fill	12" lifts, compacted to 95% maximum density as determined by AASHTO T-180. Fill should not be placed over any in-place soils until those deposits have been compacted to 95% Modified Proctor.
Around structures	Structural Fill	8" lifts, 95% of maximum density as determined by AASHTO T-180. Use light rubber-tired or vibratory plate compactors.
Beneath Paved Surfaces	Common Fill	12" lifts, 98% by maximum density as determined by AASHTO T-180 or as required by the FDOT Standards.
Open Areas	Common Fill	12" lifts, 95% by maximum density as determined by AASHTO T-180.

B. Pipe shall be laid in open trenches unless otherwise indicated on the Drawings or elsewhere in the Contract Documents.

C. Excavations shall be backfilled to the original grade or as indicated on the Drawings. Deviation from this grade because of settling shall be corrected. Backfill operation shall be performed to comply with all rules and regulation and in such a manner that it does not create a nuisance or safety hazard.

D. Embankments shall be constructed true to lines, grades and cross sections shown on the plans or ordered by the Owner. Embankments shall be placed in successive layers of not more than 8 inches in thickness, loose measure, for the full width of the embankment. As far as practicable, traffic over the work during the construction phase shall be distributed so as to cover the maximum surface area of each layer.

E. If the Contractor requests approval to backfill material utilizing lifts and/or methods other than those specified herein, such request shall be in writing to the Owner. Approval will be considered only after the Contractor has performed tests, at the Contractor's expense, to identify the material used and density achieved throughout the backfill area utilizing the method of backfill requested. The Owner's approval will be in writing.

END OF SECTION

SECTION 02221 - TRENCHING, BACKFILLING AND COMPACTING

PART I - GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor, materials, equipment and incidentals necessary to perform all trenching, removal of unsuitable or unsatisfactory material, backfilling and compaction for utilities required to complete the work shown on the Drawings and specified herein. The work shall include, but not necessarily be limited to, all trenching; all backfilling; compaction, disposal of waste and surplus materials; and all related work such as sheeting, bracing and dewatering.

B. The Contractor shall examine the site and review the available data prior to submitting his proposal, taking into consideration all conditions that may affect his work. The Owner and Engineer will not assume responsibility for variations of subsurface conditions.

C. The Contractor shall be solely responsible for the means, methods, techniques, sequences and procedures of construction, for safety precautions and programs incident to the work and regulations, ordinances, codes and orders applicable to the furnishing and performance of the work.

RELATED DOCUMENTS

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

1.03 APPLICABLE PUBLICATIONS:

A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

B. American Association of State Highway and Transportation Officials (AASHTO) Standards:

M145-82 The Classification of Soils and Soil Aggregate Mixtures for Highway Construction Purposes.

T180-74 Moisture-Density Relations of Soils Using a 10-lb. (4.54 kg) Rammer and an 18-inch (457 mm) Drop. (Modified Proctor Test).

T 191-61 Density of Soil In-Place by the Sand-Cone Method.
(R 1982)

C. Florida Department of Transportation; "Standard Specifications for Road and Bridge Construction", (FDOT) 1996 edition.

ASTM D2487: "Unified Classification System."

1.04 DEFINITIONS:

A. Common Fill: Common fill shall consist of any material classified as SW, SW-SM, SW-SC, SP, SP-SM, or SP-SC under Unified Classification System (ASTM D2487) which does not contain stones larger than 2 inches in any dimension and which has no more than 12 percent of its material by weight passing the No. 200 sieve.

B. Unsatisfactory Materials: Unsatisfactory materials shall be materials that do not comply with the requirements for common fill. Unsatisfactory materials include, but are not limited to, those materials containing roots and other organic matter, trash, debris, and stones larger than 2 inches, and materials classified in AASHTO M145 as groups A-2-4, A-2-5, A-2-6, A-2-7, A-4, A-5, A-6, A-7, A-7-5 and A-7-6. Unsatisfactory materials also include man-made fills, refuse, or backfills from previous construction.

C. Unyielding Material: Unyielding material shall consist of rock and gravelly soils with stones greater than 2 inches in any dimension, or maximum size stones as defined by the pipe manufacturer, whichever is smaller.

D. Unstable material shall consist of material without the sufficient bearing capacity to support the utility pipe conduit or appurtenance structure.

E. Select Common Fill: Select common fill shall meet the requirements for common fill specified above with the exception that select common fill shall not have more than 5 percent of its material by weight passing the No. 200 sieve. Also, the maximum allowable aggregate size for select common fill shall be 1 inch, or the maximum size recommended by the pipe manufacturer, whichever is smaller.

F. Degree of compaction: Degree of compaction shall be expressed as a percentage of the maximum density obtained by the test procedure presented in AASHTO T180. Field verification will be obtained by the test procedure presented in AASHTO T191. The term "maximum density" shall mean the maximum density determined under AASHTO T180.

G. Bedding Rock: Coarse aggregate structural bedding and support for utilities appurtenances and structures equal to FDOT Number 57, or as required by pipe manufacturer's recommendations for water mains.

1.05 PROTECTION

A. Prior to commencing trenching or dewatering, the Contractor shall take precautions to ensure that existing structures, which may be subject to settlement or distress resulting from trenching or dewatering are protected. Such precautions shall include establishing reference elevation markings on structures which are adjacent to new work and monitoring them to

ascertain evidence of settlement or distress throughout construction. If settlement or distress becomes evident, modifications to the trenching, dewatering or protection procedures shall be made to prevent additional settlement or distress and any damage caused to the structure shall be repaired at the Contractor's expense.

B. The Contractor shall furnish, put in place, and maintain such sheeting and bracing as may be required to support the sides of trenches, to prevent any movement which could in any way diminish the width of the trench below that necessary for proper construction, and to protect adjacent structures and other facilities from undermining or other damage. The stability of all excavated faces shall be maintained in compliance with the Occupational Safety and Health Administration's excavation safety standards, 29 C.F.R. S. 1926.650 Subpart P until final acceptance of the work. The Contractor shall also comply with all applicable requirements of the Florida "Trench Safety Act" (90-96, Laws of Florida), and all other applicable rules and regulations.

C. The Contractor shall, at all times during construction, provide and maintain proper equipment and facilities to remove all water entering trenches, and shall keep such trenches dry so as to obtain a satisfactory undisturbed subgrade foundation condition until the utilities to be built thereon have been completed to such extent that they will not be floated or otherwise damaged by allowing water levels to return to natural levels. Dewatering shall be conducted in such a manner as to preserve the undisturbed bearing capacity and composition of the subgrade soils at the proposed bottom of the trench. Grading shall be done as may be necessary to prevent surface water from flowing into the trench, and any water accumulating therein shall be removed so that the stability of the bottom and sides of the excavations is maintained.

1.06 SUBMITTALS

A. Submit to the Owner for review, the proposed methods of construction, including dewatering, excavation, bedding, filling, compaction, and backfilling for the various portions of the work. Review shall be for informational purposes only. The Contractor shall remain responsible for the adequacy and safety of the methods.

1.07 SOIL TESTING

The Owner will employ the services of a testing laboratory to perform all soils testing.

B. The Owner shall have sole authority over the frequency of testing and shall direct the testing laboratory in its work. The Owner may order the excavation down to any depth of backfilled material which has not been tested and have a test performed. The Contractor shall excavate for the test and backfill after the test at no additional cost to the Owner. The Contractor shall re-excavate to the depth required and re-compact any areas found to be improperly backfilled.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Only common fill or select common fill, as defined above, may be used as backfill unless otherwise directed by the Owner.

PART 3 - EXECUTION

3.01 TRENCHING

A. The trench shall be excavated as recommended by the manufacturer of the pipe to be installed and as shown on Drawings. Trench walls below the top of the pipe shall be vertical to the extent possible to 1 foot above the proposed top of pipe. From 1 foot above the top of the pipe, trench walls shall be sloped 1:1 vertical to horizontal ratio. The maximum width of trench in the vertical pipe zone shall not exceed the pipe outside diameter plus a 9 inch allowance on each side of the pipe.

B. The bottoms of trenches shall be accurately graded to provide uniform bearing and support for the bottom half of each section of the pipe. Bell holes shall be excavated to the necessary size at each joint or coupling to eliminate point bearing. The trench bottom shall be free from unyielding material. Where unyielding material is encountered in the bottom of the trench, such material shall be removed 4 inches below the required grade and replaced with select common fill compacted to minimum 95% AASHTO T-180.

C. Where unstable material is encountered in the bottom of the trench, such material shall be removed to the depth directed and replaced to the proper grade with select common fill or bedding rock as directed by the Owner.

D. Unless otherwise specified or indicated on the Contract drawings, pipe trenches shall be of a depth to provide a minimum cover of three (3) feet from the existing ground surface, or from the indicated finished grade, whichever is lower, to the top of the pipe. The pipe shall be buried a minimum of three (3) feet from the top of the pipe to the existing grade or three (3) feet below the proposed adjoining road surface grade, whichever results in the greatest depth.

3.02 DEMUCKING

A. The Contractor shall remove all muck in all areas where it is encountered. The muck shall be excavated to the depth required for complete removal, and disposed of at an approved dump site in accordance with all applicable rules and regulations. The Contractor shall notify the Owner if muck is encountered on the site.

3.03 MISCELLANEOUS EXCAVATION

A. The Contractor shall perform all the remaining miscellaneous excavation. The Contractor shall make all excavations necessary to permit the completion of the work as shown on the Drawings and specified herein.

3.04 BACKFILLING

A. Backfill material shall consist of common fill or select common fill as defined herein and as shown on the drawings. Backfill shall be placed in layers not exceeding 6 inches loose thickness for compaction by hand operated machine compactors, and 12 inches loose thickness for other than hand-operated machines, unless otherwise specified. Each layer shall be compacted to at least 95 percent of the maximum dry density as determined by AASHTO T180 for cohesionless soils unless otherwise specified. The bottoms of all excavations shall be compacted to at least 95 percent of the maximum density prior to backfill.

B. Trench Backfilling: For trenches, unyielding material removed from the bottom of the trench and unsuitable or unstable material removed from the trench shall be replaced with select common fill as specified. Replacement materials and backfill materials shall be select common fill and shall be placed in layers not exceeding 6 inches loose thickness from the bottom of the trench to 12 inches above the top of pipe. Backfill materials from 12 inches above the pipe to finished grade in unpaved areas and finished subgrade in paved areas shall be common fill placed in layers not exceeding 12 inches loose thickness. In unpaved areas, each layer of replacement material, or backfill material, shall be compacted to at least 95 percent of maximum density. In paved areas, each layer of replacement material, or backfill material, shall be compacted to at least 98 percent of maximum density. The bottoms of all trenches shall be in an undisturbed condition or, if disturbed, shall be compacted to at least 95 percent of maximum density to a depth of at least 1-foot below the trench bottom. Specified densities shall be as determined by AASHTO T180.

C. Moisture Control: Where subgrade or layer of soil material must be moisture conditioned before compaction, uniformly apply water to surface or subgrade, or layer of soil material. Prevent free water from appearing on surface during or subsequent to compaction operations.

Remove and replace, or scarify and air-dry, soil material that is too wet to permit compaction to specified density.

2. Soil material that has been removed because it is too wet to permit compaction, but is otherwise satisfactory, may be stockpiled or spread and allowed to dry until moisture is reduced to a satisfactory value.

3.05 SURPLUS MATERIAL

A. Excavated material or borrow fill to be used in construction shall be neatly piled so as to inconvenience, as little as possible, the public and adjoining property owners until used or otherwise disposed of. Suitable excavated material may be used for fill, trench backfill or backfill on the different parts of the work as required. Surplus fill shall become the property of the Contractor, and shall be removed and disposed of by him off the site.

B. The Contractor shall remove and dispose of all pieces of rock (ledge) and boulders which are not suitable for use in other parts of the work. Rock disposed of by hauling away to spoil areas is to be replaced by approved surplus excavation obtained elsewhere in the work insofar as it is available. Any deficiency in the backfill material shall be made up with satisfactory material provided by the Contractor at no additional cost to the Owner. Rock may be used in embankment fill only with approval of the Owner.

C. The right is reserved to make minor adjustments or revisions in lines or grade, if found necessary, as the work progresses, due to discrepancies on the Drawings or in order to obtain satisfactory construction of utilities.

END OF SECTION

SECTION 02222 - EXCAVATING, BACKFILLING AND COMPACTING FOR UTILITIES

PART 1 - GENERAL

1.01 SCOPE OF WORK:

This section includes excavation, bedding, and backfilling for utilities necessary to perform all work necessary to prepare for laying the piping or main, including clearing, digging the trench, preparing the pipe bed, compacting, and preparing the surface restoration, and disposal of surplus material.

Maintain in operating condition existing utilities, active utilities, and drainage systems encountered in utility installation. Repair any surface or subsurface improvements shown on Drawings.

Verify location, size, elevation, and other pertinent data required to make connections to existing utilities and drainage systems as indicated on Drawings. Comply with permits and regulations according to General Conditions.

1.02 SUBMITTALS:

Shop Drawings or details pertaining to excavation and backfill are not required unless use of materials, methods, equipment, or procedures contrary to Drawings or these specifications are proposed. Do not perform work until required shop drawings have been accepted by Owner and Engineer.

1.03 JOB CONDITIONS:

Set all lines, elevations, and grades for utility system work and control system for duration of work, including careful maintenance of bench marks, property corners, monuments, or other reference points.

1.04 TRENCH SAFETY:

Care shall be taken to strictly observe all applicable, State, local and Federal standards with respect to the safety of persons during excavation and backfill. The contractor shall recognize OSHA excavation safety standards, agree to abide by them, and identify the costs to comply. The bidder, therefore, acknowledges that the total bid price includes costs for complying the Florida Trench Safety Act (90-96, Laws of Florida), effective October 1, 1990.

1.05 JACK AND BORE, DIRECT BORE CONSTRUCTION (IF APPLICABLE):

Jack and bore, direct bore construction shall be conducted in accordance with the Florida Department of Transportation Utilities Accommodation Guide.

1.06 TESTING:

Testing shall be conducted in accordance with AASHTO T-180, modified proctor density test. Tests shall be conducted on all trench backfill within 10 feet of pavement or proposed pavement areas and under all existing paved areas.

Frequency tests shall be conducted at each public roadway crossing and at no less than 300-foot intervals along the pipeline or on each pipeline run between manholes, inlets or junction boxes in accordance with these specifications. There shall be at least one test per layer placed.

Test report results shall be furnished to the Owner and Engineer.

PART 2 - PRODUCTS

2.01 MATERIALS:

A. Bedding Material

Processed sand and gravel free from clay lumps, organic, or other deleterious material, and complying with following gradation requirements:

U.S. Sieve Size	Passing by Weight, Percent
1 Inch	100
3/4 Inch	90-100
3/8 Inch	20- 55
No. 4	0- 10
No. 8	0- 5

PART 3 - EXECUTION

3.01 EXCAVATION, TRENCHING, AND BACKFILLING:

Performing excavation as indicated or specified depths. During excavation, pile materials suitable for backfilling in orderly manner far enough from bank of trench to avoid overloading, slides, or cave-ins.

Remove excavated materials not required or not suitable for backfill or embankments and waste as specified.

Prevent surface water from flowing into trenches or other excavations by temporary grading or other methods, as required. Remove accumulated water in trenches or other excavations by pumping or other acceptable methods.

Open cut excavation with trenching machine or backhoe. Where machines other than ladder or wheel-type trenching machines are used, do not use clods for backfill. Dispose of unsuitable material and provide other suitable material at no additional cost to Owner.

3.02 TRENCH EXCAVATION:

Dig trench at proper width and depth for laying pipe, conduit, or cable. Cut trench banks as nearly vertical as practical and remove stones as necessary to avoid point-bearing. Over excavate wet or unstable soil, if encountered, from trench bottom as necessary to provide suitable base for continuous and uniform bedding. The amount of trench to be open at any one time shall be limited at the discretion of the Engineer to minimize public inconvenience and/or damage to life or property. Not more than 1,000' feet of trench shall be opened ahead of pipe laying operations, unless greater length of trench is approved by the Engineer.

All existing utilities such as pipes, poles and structures shall be carefully supported and protected from injury, and in case of damage, they shall be restored at no cost to the Owner.

Any pipes, conduits, wires, mains footings, or other underground structures encountered in trenching operations shall be carefully protected from injury or displacement. Any damage thereto shall be fully, promptly and properly repaired by the Contractor to the satisfaction of the Engineer and the Owner thereof.

Failure of the plans to show the exact location, nature or extent of any sub-surface obstruction shall not be the basis of a claim for extra work.

All trench excavation side walls greater than 5 feet in depth shall be sloped, shored, sheated, braced or otherwise supported by means of the sufficient strength to protect the workmen within them in accordance with the applicable rules and regulations established for construction by the Department of Labor, Occupational Safety and Health Administration (OSHA), and by local ordinances. Lateral travel distance to and exit ladder or steps shall not be greater than 25 feet in trenches 4 feet or deeper.

Accurately grade trench bottom to provide uniform bearing and support for each section of pipe on undisturbed soil or bedding material at every point along entire length, except where necessary to excavate for bell holes, proper sealing of pipe joints, or other required connections. Dig bell holes and depressions for joints after trench bottom has been graded. Dig no deeper, longer, or wider than needed to make joint connection properly.

The minimum width of the trench shall be equal to the outside diameter of the pipe at the bell plus six (6) inches on each side of the pipe. All other trench width requirements for pipe,

conduit, or cable shall be least practical width that will allow for proper compaction of trench backfill.

3.03 SHEETING AND BRACING:

Provide sheeting and bracing, when necessary, in trenches and other excavations where protection of workmen required. Sheeting may be removed after excavation has been backfilled sufficiently to protect against damaging or injurious caving.

3.04 PIPE BEDDING:

Accurately cut trenches for pipe or conduit that is installed to designated elevations and grades to line and grade 4" below bottom of pipe and to width as specified. Place 4" of bedding material, compact in bottom of trench, and accurately shape to conform to lower portion of pipe barrel. After pipe installation, place select backfill and compact in maximum 6" layers, measured loose, to at least 1'0" above top of pipe.

3.05 TRENCH BACKFILLING:

A. Criteria

Do not backfill trenches until required tests are performed, utility systems, as installed, comply with specified requirements, and are accepted by applicable governing authority. Backfill trenches as specified. If improperly backfilled, reopen to depth required to obtain proper compaction. Backfill and compact, as specified, to properly correct condition in an acceptable manner.

B. Backfilling

After pipe or conduit has been installed, bedded, and tested as specified, backfill trench or structure excavation with specified material placed in lifts or layers not exceeding 8" of loose material. Compact to minimum density of 95% of optimum density in accordance with ASTM D 698 or AASHTO T-99.

C. Compaction

Exercise proper caution when compacting immediately over top of pipes or conduits. Water jetting or flooding is not permitted as method of compaction.

D. Compaction Testing

Independent testing laboratory shall perform test at intervals not exceeding 300 feet of trench for each 12" of compacted trench backfill and furnish copies of test results as specified.

3.06 RESTORATION OF SURFACE:

The top surface of the trench fill shall be restored to the original or planned condition. Paved sections shall conform in grade to the adjacent area. Restoration shall be completed as promptly as practicable and shall not be prolonged until the end of the construction period.

3.07 DEWATERING:

If dewatering activity is required, unless specifically authorized by the Engineer, all pipe shall be laid "in the dry". The Contractor shall minimize the length of excavation in advance of pipe laying so as to minimize the amount of trench dewatering required. The Contractor shall dewater before trench excavation, utilizing one or more of the following approved methods: well point system, trench gravity underdrain system, or sumps with pumps.

Well point systems must be efficient enough to lower the water level in advance of the excavation and maintain it continuously in order that the trench bottom and sides shall remain firm and reasonably dry. The well points shall be designed especially for this type of service, and the pumping unit used shall be capable of maintaining of high vacuum, and at the same time, of handling large volumes of air as well as water.

If the material encountered at trench grade is suitable for the passage of water without destroying the sides or bottom of the main trench, sumps may be provided at intervals to the side of the main excavation, and pumps may be used to lower the water level by taking their suction from these sumps. In the event such pumps are employed, care shall be exercised to prevent the movement of pipe foundation material and to this end a bed of crushed stone may be required.

The Contractor shall be responsible for disposing of all water resulting from trench dewatering operations, and shall dispose of the water without damage or undue inconvenience to the work, the surrounding area, or the general public. He shall not dam, divert, or cause water to flow in excess in existing gutters, pavements, or other structures.

END OF SECTION

SECTION 02400 - SITE DRAINAGE

PART-1 - GENERAL

1.01 SCOPE OF WORK:

Installation and furnishing of all materials, equipment, and accessories to be used in the construction of the storm sewer and site drainage system.

1.02 STORM DRAINAGE STRUCTURES:

Pipe
Inlets, Manholes and Junction Boxes
Concrete Curb
Sidewalk

1.03 RELATED WORK:

Section 02222: Excavation, Backfilling, And Compacting For Utilities.

1.04 JOB CONDITIONS:

Set lines, elevations, and grades for drainage system work and control system for duration of work, including careful maintenance of bench marks, property corners, monuments, or other reference points.

PART-2 - PRODUCTS

2.01 PIPE USED SHALL MEET THE FOLLOWING SPECIFICATIONS::

Round Concrete Pipe or HDPE Pipe (over 12" in dia.) ASTM C76-70

PVC pipe (12" in diameter or less) ASTM D 3034

2.02 INLETS, MANHOLES AND JUNCTION BOXES:

Inlets, manholes and junction boxes shall be constructed of precast concrete or cast-in - place concrete. A maximum of 12 inches of brick risers may be used for precast units. If cast in place is used, no allowance for riser changes will be allowed with brick.

Concrete shall be Class I, as specified by the Florida Department of Transportation Standard Specifications for Road and Bridge Construction Latest Edition.

Mortar for brick masonry shall be of one (1) part portland cement to three (3) parts sand. Hydrated lime in an amount not to exceed ten percent (10%) of the amount of cement used may, at the Contractor's option, be added to the mortar. Masonry cement, delivered in packages properly identified with the brand name of the manufacturer and showing the net weight as well as whether it is Type 1 or Type 2, may be used in lieu of mixed mortar, provided it has not been in storage for more than six (6) months.

Grating and frames fabricated from structural steel shall be galvanized in accordance with the requirements of ASTM A123.

Forms may be of wood or metal construction, shall be constructed true to line and grade and shall be approved by the Engineer before being filled with concrete.

The Contractor may substitute precast inlets, manholes and junction boxes in lieu of cast-in-place units. Such precast units shall be in accordance with ASTM C478 or with Florida Department of Transportation Standards.

PART-3 - EXCAVATION

3.01 INLETS AND MANHOLES:

Excavation shall be in accordance with Section 02222 of these Specifications.

If the Contractor elects to construct units of cast-in-place concrete, the concrete shall be placed in the approved forms to the depths shown on the plans and thoroughly vibrated. After the concrete has hardened sufficiently, it shall be covered with suitable material and kept moist for not less than three days.

Reinforcing steel for cast-in-place construction shall be in place, securely tied and properly spaced prior to placement of the concrete.

After the concrete or mortar has cured, the frame of the casting shall be set in a full mortar bed composed of one part portland cement to two parts fine aggregate. Inlet and outlet pipes shall be of the same size and kind as the connection pipe. They shall extend through the walls for a distance beyond the outside surface sufficient for the intended connections and the concrete constructed around them so as to prevent leakage along their outer surface. The inlet and outlet pipe ends shall be flush with the inside face of the wall.

Inlets, manholes and junction boxes shall be backfilled completely by use of mechanical tampers and in six-inch (6") compacted layers.

3.02 PIPES AND PIPE CULVERTS:

Trenches for pipe culverts, storm sewers, sanitary sewers, water lines and other conductors shall be excavated to the required depth and to a width sufficient to provide adequate working room. For pipe lines placed above the natural ground line, the embankment shall be placed and compacted to an elevation of at least two feet (2') above the top of pipe and at least four (4) pipe diameters each side of the pipe before excavating the pipe trench. It is the express intent of this specification that all pipes will be placed in trenches.

For all pipe culverts, storm sewers and sanitary sewers of 24 inches or more inside diameter the pipe bedding shall be shaped to conform to the outside of the pipe, for a depth of not less than ten percent (10%) of its total outside height and recesses provided to receive the bell. For pipes of less than 24 inches inside diameter, the trench bottom may be either flat or shaped to fit the pipe, except that the recesses for bells are required in any event. The pipe barrel shall be fully supported by the trench bottom.

Where rock, boulders or other hard, lumpy or unyielding materials are encountered in the trench bottom, they shall be removed to a depth at least twelve inches (12") below the bottom of pipe and the resultant excavation backfilled. Muck or other soft material considered by the Engineer to be unsuitable as foundation for the pipe shall be removed to the depth required to obtain a firm foundation and backfilled.

All pipes shall be carefully laid, true to line and grade, with hubs up-grade and the tongue end fully entered into the hub. When pipe with quadrant reinforcement, or circular pipe with elliptical reinforcement, is used the pipe shall be installed in a position such that the manufacturer's marks designating "top" and "bottom" of the pipe shall not be more than five degrees from the vertical plane through the longitudinal axis of the pipe. Any pipe which is not in true alignment or which shows any settlement after laying shall be taken up and re-laid without additional compensation.

For all round concrete pipe, other than side drain pipe, the pipe joints shall be sealed by use of round rubber gaskets. Those gaskets shall meet the requirements of Article 5.9 of ASTM C361. Pipe joints shall meet the requirements of Article 941-1.5 of the Florida Department of Transportation Standard Specifications for Road and Bridge Construction, Latest Edition. The gasket and joints shall be free of grit, dirt and other foreign matter at the time the joints are made. In order to facilitate closure of the joint, application of an approved vegetable soap lubricant immediately prior to closing the joint will be permitted. For concrete pipe used as side drain the joints shall be welded before the inside mortar is placed and before succeeding section of the pipe are laid, the lower half of the joint portion of the pipe in place shall be filled with cement mortar and the upper half of the tongue portion of the next joint wiped with cement mortar, both in sufficient thickness to bring the inner surface of the abutting pipe flush and even when the pipe is laid. After the pipe is laid, the inside of the joint shall be wiped and finished smooth and a mortar bead not less than 3/4 inches thick shall be formed completely around the outside of the joint.

For concrete pipe laid with rubber gasket joints, any deviation from true alignment or grade which would result in a displacement from the normal position of the gasket of as much as 1/4 inch, or which would produce a gap exceeding 1/2 inch between sections of pipe for more than 1/3 of the circumference of the inside of the pipe will not be acceptable and, where such occurs, the pipe shall be re-laid without additional compensation. Where minor imperfections in the manufacturing of the pipe causes a gap greater than 1/2 inch between pipe sections, the joint will be acceptable provided the gap does not extend more than 1/3 the circumference of the inside of the pipe. No mortar, joint compound, or other filler which would tend to restrict the flexibility of the gasket joint will be applied to the gap.

Corrugated steel pipe shall be field jointed with locking bands as specified by AASHTO M36-70. The joints shall be gasketed with a rubber or neoprene gasket of a design shown to secure a soil tight or water tight joint. The gasket for annular pipe joints shall be at least seven inches wide and at least 3/8 inch thick and at least one inch thick and at least one inch (1") and five inches (5") wide for helical pipe joints. Suitable alternate joints will be considered by the Engineer if the Contractor requests such consideration. Field joints for aluminum pipe except the material used in the bands and band connectors shall be of the same alloy as the culvert sheeting and shall meet the requirements of AASHTO M196.

Immediately prior to final inspection, coated corrugated steel pipe shall be cleaned and inspected for breaks or other damage to the coating or to the pipe itself and any repairs necessary shall be made by the Contractor. Grade required shall be cut down or extended and made to conform to the required grade.

PVC pipe laying shall proceed up grade with spigot ends pointing in the direction of flow. Before pipe is joined, gaskets shall be cleared of all dirt and stones and other foreign material. The spigot ends of the pipe shall be lubricated lightly with a lubricant specified by the pipe manufacturer and approved by the project engineer. Sufficient pressure shall be applied to the pipe so as to properly seat the socket in the bell of the pipe. All pipes shall be laid straight, true to the lines and grades shown on the plan.

Where manholes are to be raised, the adjustment may be made, if the Contractor so chooses, by the use of adjustable extension rings of the type which do not require the removal of the existing manhole frame. The extension device shall provide positive locking action and shall permit adjustment in height as well as diameter. The particular type of device used shall meet the approval of the Engineer.

3.03 CONCRETE CURB & SIDEWALK:

A. Concrete Curb

All concrete curb shall be constructed in accordance with the Florida Department of Transportation Standard Specifications of Road and Bridge Construction,

Section 520.

B. Concrete Sidewalk

This work shall consist of constructing cement concrete sidewalks in accordance with these specifications and within reasonable close conformity to the lines, grades and dimensions shown on the drawings established by the Engineer. Materials for sidewalk construction shall be 2500 psi, concrete and Class I (DOT) steel wire fabric AASHTO Designation M-55. The foundation for the bed shall be formed a depth of 4 inches below and parallel with the finished surface of the sidewalks, unless otherwise indicated on the drawings or specified. Unsuitable material shall be removed and replaced with approved material, and the foundation shall be thoroughly compacted and finished to a firm, even surface. Edge dimensions shall conform to the plan details, with one #5 continuous bar on each side.

Forms shall be of wood or metal, straight, free from warp, and of sufficient strength when staked to resist the pressure of the concrete without springing. If wood, they shall be nominal 2-inch planks surfaced on the inside and the top; or if of metal, they shall be of approved section. Forms shall have a depth equal to the depth of the concrete and shall be thoroughly cleaned and oiled before concrete is placed against them. Forms that are worn, bent, or damaged shall not be used.

Sidewalks shall be constructed in separate slabs 15 feet in length except for closures. These slabs shall be separated by transverse premolded expansion joint filler, if an inch in thickness, for the full depth of the concrete. Transverse premolded expansion joint filler shall also be placed adjacent to existing structures where directed. The slabs between expansion joints shall be divided into blocks 5 feet in length, by scoring transversely. Where the slabs are more than 5 feet in width they shall be scored longitudinally in the center. Transverse and longitudinal scoring shall extend for a depth of at least the thickness of the concrete slab.

Premolded expansion joint filler, of an inch in thickness for the full depth of the concrete, shall be placed longitudinally where the sidewalk slab is to be constructed in contact with curbs.

Where existing light standards, poles, fire hydrants, and similar structures are within the limits of the sidewalk area, the concrete around such structures shall be scored in a block 8 inches wider than the maximum dimension of the structure at the sidewalk elevation. Prior to placing the concrete around such structures, premolded expansion joint filler, of an inch in thickness, shall be placed around the structure for the full depth of the concrete in the sidewalk.

The concrete shall be placed in the forms and tamped and spaded to prevent

honeycomb and until the tip of the structure can be floated smooth and the edges rounded to the radius shown in the plans. A light broom finish shall be applied once the concrete has set enough to be permanently marked.

Side forms shall not be removed within 12 hours after the concrete has been placed. After removal of the forms, minor honeycombed areas shall be filled with mortar composed of 1 part of cement and 2 parts of fine aggregate. Major honeycombed areas will be considered as defective work, and shall be removed and replaced at no expense to the Owner.

All expansion joints, and scoring cracks where required, shall be sealed with joint sealing material having ASTM designation D1190.

After the concrete has cured for a period of not less than 72 hours, the spaces adjacent to the sidewalk shall be backfilled with approved material in layers of not more than 4 inches in depth, which shall be thoroughly compacted mechanically to the required elevation and cross-section.

END OF SECTION

SECTION 02 4116
STRUCTURE DEMOLITION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes removal and off site disposal of demolished buildings, including, but not limited to, the following kinds of existing elements:
 - 1. Building structure(s) as indicated on drawings
 - 2. Entrance drive
 - 3. Curbs
 - 4. Parking structures
 - 5. Adjacent site improvements to limits indicated on drawings
 - 6. Building foundations and supporting walls to a uniform depth of 12 inches below lowest foundation elevation

1.2 SUBMITTALS

- A. Schedule of operations indicating coordination for shutoff, capping, and continuation of utility services as required.
 - 1. Provide a detailed sequence of demolition and removal work to ensure uninterrupted progress of Owner's on-site operations.
- B. Submit digital photographs in JPEG format of existing adjacent structures and site improvements.
- C. Project Record Documents:
 - 1. Record actual locations of capped utilities and subsurface obstructions.

1.3 QUALITY ASSURANCE

- A. Demolition Firm: Company specializing in performing the Work of this Section with minimum five (5) years documented experience.
- B. Regulatory Requirements:
 - 1. Conform to FBC and local ordinances for demolition of structures, safety of adjacent structures, dust control runoff control and disposal.
 - 2. Notify affected utility companies before starting demolition work.
 - 3. Do not close or obstruct roadways, sidewalks, or hydrants.
 - 4. Conform to applicable regulatory procedures when discovering hazardous or contaminated materials.
 - 5. Test soils around buried tanks for contamination.
 - a. Any soil testing that the Owner requires will be paid for by the Owner through a Change Order.

1.4 PROJECT CONDITIONS

- A. Occupancy: Structures to be demolished will be vacated and use discontinued prior to start of Work.
- B. Condition of Structures: Owner assumes no responsibility for actual condition of structures to be demolished.
 - 1. Conditions existing at time of inspection for bidding purpose will be

maintained by Owner insofar as practicable. However, variations within structure may occur by Owner's removal and salvage operations prior to start of demolition work.

- C. Salvaged Materials: Items of salvable value to Contractor may be removed from structure as work progresses. Transport salvaged items from site as they are removed.
 - 1. Storage or sale of removed items will not be permitted on site.
- D. Explosives: Use of explosives will not be permitted.
- E. Traffic: Conduct demolition operations and removal of debris to ensure minimum interference with roads, streets, walks, and other adjacent occupied and used facilities.
 - 1. Do not close or obstruct streets, walks, or other occupied or used facilities without permission from authorities having jurisdiction. Provide maintenance of Traffic plan when required by governing regulations.
- F. Protections: Ensure safe passage of persons around area of demolition. Conduct operations to prevent damage to adjacent buildings, structures, and other facilities and injury to persons.
 - 1. Erect temporary covered passageways as required by authorities having jurisdiction.
 - 2. Provide interior and exterior shoring, bracing, or support to prevent movement, settlement, or collapse of structures to be demolished and adjacent facilities to remain.
- G. Damages: Repair damages to adjacent facilities caused by demolition operations.
- H. Utility Services: Maintain existing utilities indicated to stay in service and protect against damage during demolition operations.
 - 1. Do not interrupt existing utilities serving occupied or used facilities, except when authorized in writing by authorities having jurisdiction. Provide temporary services during interruptions to existing utilities, as acceptable to governing authorities.

PART 2 - PRODUCTS – Not Used

PART 3 - EXECUTION

3.1 PREPARATION

- A. Provide, erect, and maintain temporary barriers and security devices.
- B. Protect existing landscaping materials and structures which are not to be demolished.
- C. Prevent movement or settlement of adjacent structures. Provide bracing and shoring.
- D. Existing Utilities: Locate all existing underground utilities prior to demolition work. Hand-dig in areas where utilities are found. Protect all transformers, A/C units, conduit, and piping during demolition that are to remain. Provide additional shoring, bracing, or sheet piling in areas requiring protection of existing

equipment.

3.2 DEMOLITION REQUIREMENTS

- A. Conduct demolition to minimize interference with adjacent structures and items.
- B. Cease operations immediately if adjacent structures appear to be in danger. Notify Architect. Do not resume operations until directed.
- C. Conduct operations with minimum interference to public or private accesses. Maintain protected egress and access at all times.
- D. Obtain written permission from adjacent property owners when demolition equipment will traverse, infringe upon or limit access to their property.

3.3 DEMOLITION

- A. Pollution Controls: Use water sprinkling, temporary enclosures, and other suitable methods to limit dust and dirt rising and scattering in air. Comply with governing regulations pertaining to environmental protection.
 - 1. Do not use water when it may create hazardous or objectionable conditions such as flooding or pollution.
- B. Clean adjacent structures and improvements of dust, dirt, and debris caused by demolition operations. Return adjacent areas to condition existing prior to start of work.
- C. Building Demolition: Demolish buildings completely and remove from site. Use such methods as required to complete work within limitations of governing regulations.
 - 1. Proceed with demolition in systematic manner, from top of structure to ground. Complete demolition work above each floor or tier before disturbing supporting members on lower levels.
 - 2. Demolish concrete and masonry in small sections.
 - 3. Remove structural framing members and lower to ground by hoists, derricks, or other suitable methods.
 - 4. Break up and remove concrete slabs-on-grade, unless otherwise shown to remain.
 - 5. Locate demolition equipment throughout structure and remove materials so as to not impose excessive loads to supporting walls, floors, or framing.
- D. Below-Grade Construction: Demolish foundation walls and other below-grade construction, including concrete slabs, to a depth of not less than 12 inches below lowest foundation level.
- E. Soil Treatment: Employ a certified, licensed exterminator and treat entire area of building demolition and removal in accordance with governing state and local health regulations.

3.4 DISPOSAL OF DEMOLISHED MATERIALS

- A. Remove accumulated debris, rubbish, and other materials resulting from demolition operations.
 - 1. Burning combustible materials from demolished structures will not be permitted on Site.

- B. Removal: Transport materials removed from demolished structures and legally dispose off site.

END OF SECTION 02 4116

SECTION 02500 - ROADWAY BASE COURSE

PART 1 - GENERAL

1.01 SCOPE OF WORK:

Furnish and install roadway and parking area base course in accordance with the contract drawings and specifications.

REFERENCED PUBLICATIONS:

A. Florida Department of Transportation "standard specifications for road and bridge construction" latest edition, hereafter referred to as FDOT Standard Specifications.

RELATED SECTIONS:

Section 02200 – Earthwork

Section 02511 – Asphaltic Concrete Paving

PART 2 - PRODUCTS

2.01 Base course material shall be in accordance with FDOT Standard Specifications, Section 200, Limerock Base or Section 204, Graded Aggregate Base.

A. Limerock may be of either Miami or Ocala formation and shall meet the following requirements:

- 1) Minimum percentage of carbonates of calcium and magnesium in the limerock material shall be seventy (70) percent.
- 2) Maximum percentage of water sensitive clay material shall be three (3) percent by weight.
- 3) Maximum Liquid Limit shall not exceed thirty-five (35).
- 4) Plastic Index shall not exceed ten (10).
- 5) At least ninety-seven (97) percent of the material, by weight, shall pass a three and one half (3 1/2) inch sieve and the material shall be graded uniformly down to dust. All crushing or breaking-up, which is necessary to meet this requirement, shall be done before the material is placed on the roadbed.
- 6) Material shall not contain cherty or other extremely hard pieces, or lumps, balls or pockets of sand or clay size materials in sufficient quantity as to be detrimental to the proper bonding, finishing or strength of the limerock base.

2.02 PRIME COAT:

A. Materials

Unless otherwise called for on the plans or in Special Provisions, material used in the prime coat shall be Cut-Back Asphalt, Grade RC-70 or RC-250 or Emulsified Asphalt, Grade RS-2. Cutback Asphalt shall meet the requirements of AASHTO M81 except that the penetration range shall be 60-120 instead of 80-120. Emulsified Asphalt shall meet the requirements of AASHTO M140 (for anionic) and M208 (for cationic). The viscosity requirements for Grade RS-2 shall not apply. Other types and grades of bituminous material may be allowed if it can be shown that the alternate material will properly perform the function of prime coat material.

Cover material shall consist of a sand bituminous hot- mix containing from two (2) to four (4) percent Asphalt Cement, viscosity Grade AC-20 and fine aggregate consisting of a clean sand or screenings. Sand shall contain no more than ten (10) percent material by weight, passing the No.200 sieve. Screenings shall not contain any material retained on a three eighth (3/8) inch sieve and not more than ten (10) percent, by weight, passing the No.200 sieve.

PART 3 - EXECUTION

3.01 Equipment

Limerock shall be spread by mechanical rock spreaders equipped with a device to strike the rock off uniformly to laying thickness and capable of producing an even distribution of the rock. In areas where the use of a mechanical spreader is impractical, and with the approval of the Architect, limerock may be spread by means of a dozer or grader blade.

Hauling, Spreading And Compacting: As much as possible, rock shall be hauled over rock previously placed. Hauling over the subgrade is permitted, provided that any soft spots that develop in the subgrade as a result of that hauling shall be immediately repaired to the satisfaction of the Architect.

When the specified compacted thickness of the base is six (6) inches or less, the base shall be constructed in one (1) layer. For bases of greater than six (6) inch thickness, the base shall be constructed in two (2) or more layers, with the final layer approximately one-half (1/2) the total thickness, but in no case less than four (4) inches. Before compaction effort starts, all segregated areas of fine or coarse rock shall be removed and replaced with properly graded rock.

After the limerock has been spread, it shall be brought to the proper moisture content by wetting or drying. When water is added, it shall be uniformly mixed-in by disking to the full depth of the course which is being compacted. Wetting or drying operations shall be across the full width and the full depth of the course being compacted.

The limerock base for roadways shall be compacted to a density of not less than ninety-five (95) percent of the maximum density as determined by AASHTO T180. Limerock base for shoulder

paving or under sidewalks or driveways shall be compacted to a density of not less than ninety-five (95) percent of the maximum density as determined by AASHTO T180.

Density tests shall be made on each day's final compaction operation on each course. The frequency of those tests shall be as specified herein. All bladeing, manipulation or other operations shall be complete prior to performing the tests.

If, at any time, subgrade material should become mixed with the base material, the contaminated base material shall be removed and replaced with suitable material. If the subgrade has been affected to the degree its integrity is questionable, then that subgrade shall be replaced as well.

3.02 FINISHING BASE:

Limerock base shall be finished to true line, grade and cross-section. As soon as the finishing operation is complete the finished surface shall be checked with a template cut to the required cross-section and with a fifteen (15) foot straightedge laid parallel to the road. The straightedge shall be placed in alternating overlaps to assure complete coverage. Any straightedge shall be placed in alternating overlaps to assure complete coverage. Any irregularities greater than three eighths (3/8) inch shall be corrected by scarifying and removing or adding rock as needed after which the area shall be re-compacted and re-tested.

Thickness of base shall be measured at the intervals as specified herein. Base which is deficient by more than five (5) percent of its planned thickness shall be corrected by scarifying, adding rock, reshaping and recompacting for a distance of one hundred (100) feet each side of the edge of the deficient area. As an exception to this requirement, where only one area is deficient and that area is less than twenty (20) feet long, or less than one (1) percent of the total day's base work, whichever is smaller, then the Architect may waive the requirement for reconstructing the area providing the deficiency is less than ten (10) percent of the planned thickness.

3.03 APPLICATION OF PRIME COAT:

Before any bituminous material is applied, all loose material, dust, caked clay, dirt and other foreign material which might prevent proper bond with the existing surface shall be removed for the full width of the application.

Bituminous material shall be applied by pressure distributor equipped with pneumatic tires having a sufficient width of rubber in contact with the road surface to avoid breaking the bond or forming a rut in the surface. The outside nozzle at each end of the spray bar shall have an opening of not less than twenty-five (25) percent nor more than seventy-five (75) percent in excess of the interior nozzles. All other nozzles shall have uniform

openings and shall be spaced so as to provide an even distribution of the bituminous material on the surface.

The surface to be primed shall be lightly sprinkled with water and rolled with a traffic roller immediately before applying the bituminous material.

The moisture content of the base material shall not exceed ninety (90) percent of the optimum moisture of the material at the time the prime material is applied. The bituminous material shall be applied by a pressure distributor at a temperature between 100 degrees F. and 150 degrees F., that will insure even distribution.

The rate of application shall be not less than 0.10 gallon per square yard. Sand-bituminous hot-mix shall be applied at the rate of ten (10) pounds of mix per square yard.

The entire surface, after covering, shall be rolled with a traffic roller to obtain a reasonable dense mat.

3.03 FIELD QUALITY CONTROL:

An Independent Testing Laboratory approved by the Owner and paid by the contractor, shall be retained to perform construction testing on site except as may be amended in the supplemental conditions.

Fill Placed in Areas to be Paved: At least one compaction test of every 2,000 sq. ft. of each eight (8) lift or layer.

If compaction requirements are not complied with at any time during construction process, remove and recompact deficient areas until proper compaction is obtained at no additional expense to Owner.

The following tests shall be performed on each type of material used as compacted fill as part of construction testing requirements:

Moisture and Density Relationship: ASTM D 698.

Mechanical Analysis: AASHTO T-88.

Plasticity Index: ASTM D 424.

Field density tests for in-place materials shall be performed according to one of the following standards as part of construction testing requirements.

Sand-Cone Method: ASTM D 1556.

Nuclear Method: ASTM D 2922.

Base course construction testing shall be performed as follows:

Base Material Thickness: Perform one test for each 8,000 sq. ft. in-place base course.

Base Course Compaction: Perform one test for each 2,000 sq. ft. of in-place course.

Test each source of material for base course in accordance with applicable state highway specifications.

Owner, Engineer and Contractor shall be provided with copies of reports within twenty-four (24) hours of time test was performed.

In event that any test performed fails to meet these Specifications, Owner and Contractor shall be notified immediately by Independent Testing Laboratory.

Owner reserves right to employ Independent Testing Laboratory and to direct any testing that is deemed by Owner to be necessary. Contractor shall provide free access to site of testing activities.

END OF SECTION

SECTION 02511 - ASPHALTIC CONCRETE PAVING

PART 1 - GENERAL

1.01 SCOPE OF WORK:

Furnish and install asphaltic concrete paving, including prime and tack coat in accordance with the contact drawings and specifications.

1.02 REFERENCED PUBLICATIONS:

A. "Standard Specifications for Road and Bridge Construction," Florida Department of Transportation (latest edition), hereafter referred to as "FDOT Standard Specifications"

1.03 RELATED SECTIONS:

Section 02500 – Roadway Base Course

1.04 SUBMITTALS

A. Design Mix:

Before any asphalt surface is constructed, the Contractor shall submit actual design mix for asphalt to the Project Manager for acceptance.

B. Material Certificates:

Furnish copies of materials certificates signed by material producer and Contractor certifying that each material item complies with, or exceeds, specified requirements.

1.04 JOB CONDITIONS

A. Weather Limitations:

Apply prime and tack coats when ambient temperature is above 50 percent, and when temperature has not been below thirty-five (35) degrees for twelve (12) hours immediately prior to application. Do not apply when base is wet or contains excess moisture.

Construct asphalt concrete surface course when atmospheric temperature is above forty (40) degrees and when base is dry. Base course may be placed when air temperature is above thirty (30) degrees and rising.

B. Grade control:

Establish and maintain required lines and elevations.

PART 2 - PRODUCTS

2.01 ASPHALTIC CONCRETE

This section specifies the material, the compositions, and the job mix formula for Type S asphaltic concrete pavements as specified in Section 331 of the Standard Specifications. The requirements for plant and equipment for these pavements are specified in Section 320 of the FDOT Standard Specifications. The Contractor shall submit a job mix formula as required by FDOT Standard Specification, Section 331.4.3, prior to the start of production.

2.02 PRIME AND TACK COAT

Governing specifications for materials shall be as per FDOT Standard Specifications, Section 300, Prime and Tack Coats for Base Courses.

PART 3 - EXECUTION

3.01 PREPARATION

Remove loose material from compacted base surface to check for unstable areas and areas requiring additional compaction. Do not begin paving work until deficient base areas have been corrected and are ready to receive paving.

3.02 PRIME COAT

Apply bituminous prime coat to base surfaces where asphaltic concrete paving will be constructed.

Apply bituminous prime coat in accordance with FDOT Standard Specification, Section 300-6.

Apply at minimum rate of 0.20 to 0.50 gal./sq. yd. 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 volatile.

3.03 TACK COAT

Apply to contact surfaces of previously constructed asphalt or portland cement concrete and surfaces abutting or projecting into asphalt concrete and surfaces abutting or projecting into asphalt concrete pavement.

Apply tack coat to full depth asphalt and sand asphalt base. Apply emulsified asphalt tack coat between each lift or layer of full depth asphalt and sand asphalt bases and on surface of such bases where asphaltic concrete paving will be constructed.

Apply emulsified asphalt tack coat in accordance with FDOT Standard Specification Section 300-7.

Distribute at rate of 0.05 to 0.15 gal./sq.yd. of surface.

Allow tack coat to dry until at proper condition to receive paving.

3.04 PLACING MIX

Place asphalt concrete mixture on prepared surface, spread, and strike off. Spread mixture at following minimum temperatures:

When ambient temperature is between forty (40) degrees F and fifty (50) degrees F: Two hundred eight-five (285) degrees F.

When ambient temperature is between fifty (50) degrees and sixty (60) degrees F: Two hundred eighty (280) degrees F.

When ambient temperature is higher than sixty (60) degrees F. Two hundred seventy-five (275) degrees F.

Place inaccessible and small areas by hand. Please each course to required grade, cross-section, and compacted thickness.

3.05 PAVER PLACING

Place in strips not less than 10'-0" wide, unless otherwise acceptable to Owner. After first strip has been placed and rolled, place succeeding strips and extend rolling to overlap previous strips. Complete base course for section before placing surface course.

3.06 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.

3.07 ROLLING

Begin rolling when mixture will bear roller weight without excessive displacement.

Compact mixture with hot hand tampers or vibrating plate compactors in areas inaccessible to rollers.

3.08 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.

3.09 SECOND ROLLING

Follow breakdown rolling as soon as possible, while mixture is hot. Continue second rolling until mixture has been thoroughly compacted.

3.10 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.

3.11 PATCHING

Remove and replace paving areas mixed with foreign materials and defective areas. Cut out such areas and fill with fresh, hot asphalt concrete. Compact by rolling to maximum surface density and smoothness.

3.12 PROTECTION

After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened.

Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked.

3.13 FIELD QUALITY CONTROL

Independent Testing Laboratory, selected and paid by Contractor, shall be retained to perform construction testing of in-place asphalt concrete courses for compliance with requirements for thickness and surface smoothness. Asphalt surface and base course shall be randomly cored at a rate of one core for every 20,000 square feet of paving. However, no less than three cores in light duty areas and three cores in heavy-duty areas shall be obtained. Asphalt pavement samples shall be tested for aggregate gradation and bitumen content for conformance with the mix design. The asphalt pavement shall also have Extraction and Marshall Stability tests taken on the material placed each day. Density of asphaltic concrete surface course shall be 93 percent of job mix Marshall Laboratory density.

ACCEPTANCE OF MIXTURE

Plant Mixture

1. Acceptance of the bituminous mixture at the plant will be based on the Contractor's testing lab results. Asphalt must meet a minimum Marshall Stability of 1500 lbs. Extraction and Gradation results shall meet the variance acceptable values provided in Table 331-6. One sample shall be tested in the morning and one in the afternoon for each day's paving.

Any load or loads of mixture, which in the opinion of the Project Manager or Owner are unacceptable due to being segregated, aggregates improperly coated, or an excessively high or low temperature, shall be rejected for use in the work. The Owner may reject the asphalt or direct the Contractor to remove the asphalt due to failure to meet any F.D.O.T. requirements.

Field Density Requirements

Field density requirements shall conform to F.D.O.T. – Section 330-10.3.

3.15 THICKNESS

In-place compacted thickness shall not be less than thickness specified on the drawings.

3.16 SURFACE SMOOTHNESS

Test finish surface of each asphalt concrete course for smoothness, using 10'-0" straightedge applied parallel with, and at right angles to centerline of paved area. Surfaces will not be acceptable if exceeding following tolerances for smoothness:

Base Course Surface: 1/4"

Wearing Course Surface: 3/16"

Check surface areas at intervals necessary to eliminate ponding areas.

Repair or remove and replace unacceptable paving as directed by Owner.

Areas of deficient paving thickness shall receive a minimum 3/4" overlay until specified thickness of the course is met or exceeded.

END OF SECTION

SECTION 02520 - SITWORK CONCRETE

PART 1 - GENERAL

1.01 DESCRIPTION

A. Construction of concrete curb and gutter, concrete valley gutters and sidewalk, as shown on the Drawings and as herein specified.

B. Related Work Specified Elsewhere

1. Section 02221: Trenching, Backfilling and Compacting

C. Supplementary Specifications

1. All Florida Department of Transportation Standard Specifications for Road and Bridge Construction - 1991 (FDOT Standard Specs) herein referred to and/or herein amended form a part of these technical specifications.

1.02 QUALITY ASSURANCE

A. Qualifications of Installer

1. At all times during execution of this portion of the work, provide at least 1 person who is thoroughly familiar with the type of materials being installed and is directly responsible for all work performed under this section.

B. Quality Control Requirements

1. Requirements shall be as set forth in other related specifications as herein referred to.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Concrete

1. All work under this section shall be of Class II concrete, as set forth in FDOT Standard Specifications.

B. Steel

1. All reinforcing steel shall be Grade 60 Reinforcement, in accordance with the provisions set forth in FDOT Standard Specifications Section 415 "Reinforcing Steel".

C. Joint Materials

1. All joint materials shall be in accordance with the provisions set forth in FDOT Standard Specifications Section 932-1 "Joint Materials".

PART 3 - EXECUTION

3.01 CONSTRUCTION

A. Concrete Gutter, Curb Elements and Traffic Separator

1. Concrete curb and gutter and concrete valley gutter construction shall be in accordance with FDOT Standard Specifications 520 "Concrete Gutter, Curb Elements and Traffic Separator", except as hereinafter amended and as shown on the Drawings.

B. Concrete Sidewalks

1. Construction shall be in accordance with FDOT Standard Specifications Section 522 "Concrete Sidewalk", except as hereinafter amended and as shown on the Drawings.

END OF SECTION

02577 - PAVEMENT MARKINGS

PART-1 - GENERAL

1.01 SCOPE OF WORK:

Furnish all tools, equipment, materials, machinery, appurtenances and labor, unless otherwise specified to establish all pavement markings for fire lanes, lane striping, parking, stall striping, handicapped symbols and other necessary striping for traffic control and public safety.

The Contractor shall maintain access for vehicular and pedestrian traffic as required for other construction activities.

Flagman shall be utilized, where necessary, along with barricades, warning signs, and warning lights.

1.02 RELATED WORK

Florida Department of Transportation Standard Specifications for road and bridge construction latest edition (referred to herein as "Standard Specifications").

PART-2 - PRODUCTS

2.01 MATERIALS:

The paint utilized for striping shall be Thermoplastic compound meeting AASHTO M 249-79 as detailed in Section 711-2 of the Standard Specifications. The paint colors shall be selected as follows:

Exterior Sidewalk Curbs:	Yellow (Per D.O.E.)
Lane Striping:	White
Handicapped Symbols:	Blue
Parking Stall Striping:	White

PART-3 - EXECUTION

3.01 PREPARATION:

Application surface shall be swept and cleaned to eliminate loose materials and dust per Section 710-6.3 of the FDOT Standard Specifications.

3.02 APPLICATION:

All paint shall be applied in accordance with the manufacturer's recommendations and Section 711-4 of the FDOT Standard Specifications.

Paint shall be applied with mechanical equipment to provide uniform and straight edges.

END OF SECTION

SECTION 02820 - GRASSING

PART 1 - GENERAL

1.01 SCOPE OF WORK

- A. This Section shall govern the furnishing of all sod, labor, materials, equipment and services necessary for the complete installation of all sodding and other items necessary to complete the work as shown on the Drawings and as specified herein.
- B. Unless otherwise indicated, the Contractor is responsible for the repair of any existing lawn areas disturbed during the construction process
- C. The Contractor is responsible for the irrigation of all lawn areas on the project, including those not covered by an irrigation system.
- D. The Contractor is responsible for the all maintenance to the Bermuda grass lawns during a minimum 2-month grow in period.

1.02 GENERAL REQUIREMENTS

- A. See Drawings for area to be sodded.
- B. Labor crews shall be directed by a landscape foreman experienced in plant materials, planting, reading blueprints, and coordination between job and nursery.
- C. Coordinate work with other related work in order to expedite installation of work.

1.03 BERMUDA GRASS FIELD INSTALLER QUALIFICATIONS

- A. A contractor specializing in the grading and grassing of athletic fields shall grade and install the Bermuda grass field. The specialty contractor shall submit a list of athletic field projects successfully completed during the past three years, including a list of three similar Bermuda grass sports field projects for the approval of the Landscape Architect and the Owner. Include information concerning the project Owner and references with telephone contact numbers.

1.04 APPLICABLE DOCUMENTS

- A. The following publications of the issues listed below form a part of this Specification.
 - 1. American Joint Committee on Horticultural Nomenclature (AJCHN) Standard Plant Names, Second Edition (1942).
 - 2. American National Standards Institute (ANSI)-Z60.1-2004 Nursery Stock (sponsored by the American Association of Nurserymen, Inc.)
 - 3. Grades and Standards for Nursery Plants, Parts I and II, State Plant Board of Florida.

1.05 SUBMITTALS

- A. Provide submittals per contract documents.
- B. Provide submittals for the following products for the Landscape Architect's approval of prior to start of work on the sodding.
 1. Fertilizer
 2. For all Bermuda grass fields, submit planting soil analyses of the existing and imported soils for approval at no additional cost to the Owner. If the soil composition within the field area is uniform, collect cores for a composition sample from approximately six dispersed areas and within the top 6" of the soil. The analysis shall show % of organic material in the soil through the loss on Ignition by Volume soil test method, indicate the soil pH and with recommendations from the testing laboratory for additional topsoil, fertilizer type and application rate, and other soil amendments necessary to bring the top 6" of soils in the Bermuda grass areas to the following specified levels:
 - a. Percolation rate: minimum 4" per hour in the top six inches of soil
 - b. PH level: 6.0 - 7.0
 - c. Soil Organic Content 5% minimum /20% maximum
 - d. Major and Minor nutrients as recommended by the laboratory
 - e. A Florida agricultural testing laboratory acceptable to the Landscape Architect and the Owner shall perform all testing and recommendations.
 3. Herbicides
 4. Fire ant certification from the sod supplier
 5. Specialty grading and grassing contractor information as noted in Section 1.03 above.
- C. Operation Data: Submit for continuing Owner maintenance.
- D. Maintenance Data: Include maintenance instructions, cutting method and maximum grass height, types, application frequency, and recommended coverage of fertilizer.

PART 2 - MATERIALS

2.01 TOPSOIL

- A. If the quantity of existing stored or excavated topsoil is inadequate for sodding, 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 a mixture of subsoil and free from Johnson grass (*Sorghum halepense*), nut grass (*Cyperus rotundas*) and objectionable weeds and toxic substances.

2.02 LIME

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

2.03 FERTILIZER

- A. Commercial fertilizer shall be 8-8-8 formulation for all Bahia sod, of which 60% 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% is held on a 16-mesh screen, uniform in composition, dry and free-flowing.
- B. Fertilizer for Bermuda grass shall be 15-5-15 with the rate and minor nutrients as recommended by the agricultural laboratory performing the tests on the project topsoil.

2.04 SOD

- A. Shall be Tifway 419 Bermuda and Argentine Bahia as noted on the Drawings. Sod shall be fresh, healthy, living stems (stolons or rhizomes) with 50% or more of the stems being rhizomes) and attached roots. Sod shall be obtained from approved sources where the sod is heavy and thickly matted and free from ground pearl and fairy ring. The soil depth shall be uniform and 1"-1 1/2" thick. Sod shall be free of nut grass (*Cyperus rotundas*), Johnson grass (*Sorghum halepense*), and other objectionable weeds, and shall not contain material that might be detrimental to the development of the turf.

2.05 REQUIREMENTS:

- A. All areas within the limits of work indicated for sodding and all areas disturbed by the Contractor's operations, shall be grassed (sodded).
- B. All Tifway 419 Bermuda shall be installed from rolled material.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Grading: Areas to be grassed shall be graded to remove depressions, undulations, and irregularities in the surface before grassing.
- B. Tillage: When it is determined by a Landscape Architect that the soil conditions warrant special attention, the area to be grassed shall be thoroughly tilled to a depth of 3" using a plow and disc harrow or rotary tilling machinery until a suitable seed bed has been prepared and no clods or clumps remain larger than 1"-1 1/2" in diameter.
- C. Applying Lime: The pH of the soil shall be determined. If the pH is below 5.0, sufficient lime shall be added to provide a pH between 5.5 and 6.5. The lime shall be thoroughly incorporated into the top three to four inches of the soil. Lime and fertilizer may be applied in one operation.
- D. Applying Fertilizer:

1. For all Bahia sod, fertilizer shall be applied at the rate of 10 pounds per 1,000 sq. ft. and shall be broadcast over the surface after the sod has been placed. The rate of application for Bermuda grass shall be as recommended by the agricultural testing laboratory. Uniformly apply the fertilizer over the area receiving grass by using an approved distribution device calibrated to distribute the appropriate quantity. Do not fertilize when the wind velocity exceeds 15 miles per hour.
 2. Fertilize Bahia sod 30 days after installation, and request an inspection to verify the application of the fertilizer.
 3. Fertilize Bermuda sod both 30 and 60 days after installation, and request an inspection to verify the application of the fertilizer.
- E. Fumigation of the Bermuda Grass Lawn Areas: The Contractor shall fumigate the lawn areas receiving Bermuda grass to eradicate all soil organisms, all existing vegetation is, and all plant seeds and other forms of plant regeneration. The Contractor shall use a soil fumigation method that guarantees all vegetative matter and soil organisms in the soil are eradicated. Use all soil fumigants and other materials as specified and recommended by the manufacturer(s).
- F. Fine Grading:
1. After removal of debris, perform fine grading as required to bring all areas to receive grass to a smooth, even, and finished grade. Use a laser grader to fine grade areas receiving Bermuda grass. Fine grade other areas receiving grass by raking to eliminate wind rows, ridges, depressions and other irregularities. The Contractor shall fine grade areas receiving sod as necessary to achieve a finished grade (top of the sod) as specified in this section.
 2. All sodded areas bordered by sidewalks, asphalt pavement, or curbs shall have a finished grade (top of the sod's soil) that is flush (or less than 1/2" below) with the grade of the adjacent sidewalk, asphalt pavement, or curb.
 3. All sodded areas bordered by planting areas shall have a finished grade (top of the sod's soil) that is 1 1/2" above the soil level in the adjacent planting bed.
- G. Sodding: Sod shall be placed within 48 hours of harvesting. In addition sod shall not be left stacked or rolled for longer than 24 hours.
- H. Placing Sod:
1. The soil shall be soaked just prior to placing sod. Each block or strip of sod shall be butted firmly against the last. Gaps shall be filled with pieces of sod and topsoil. The sod shall not be stretched while placing. Immediately after placing sod, roll to provide firm contact with soil.
 2. Place Bermuda grass sod field as required to produce a smooth and even surface conforming to the grades indicated on the project civil engineering plans. All field areas shall be laser graded as required to produce the required surface finish. The Contractor shall ensure that the finished grade of sod does not vary more than 1/4" from a 10' long straight edge. Remove any mesh backing on the Bermuda grass from the sod and from the project site.

- I. Watering: Sodding will not be authorized unless the planting soil has a moisture content level sufficient to prevent the immediate drying out of newly placed sod. Water shall be applied prior to sodding operations. At least one-half inch of water shall be applied uniformly to all areas to be sodded. In addition, watering will be required over all areas on which sodding has been completed. This application shall be made not later than 30 minutes after sodding has been completed and shall amount to at least one-half inch of water over the entire area sodded. Watering shall be done in a manner which will prevent erosion due to the application of excessive quantities in a concentrated area. Water source shall be provided by the Owner.
- J. Winter Cover: All areas to be grassed shall be protected against erosion at all times. For protection during winter months, Italian rye grass shall be planted at the rate of four pounds per 1000 sq. ft. on all areas which are not protected by permanent grass.
- K. Clean-Up: All excess soil, excess grass materials, stones, 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.
- L. Maintenance shall begin immediately following the last operation of sodding and continue until final acceptance. Maintenance shall include watering, mowing, edging, replanting, and all other work necessary to produce a uniform stand of grass. Grassing will be considered for final acceptance when the permanent grass is healthy and growing on 100% of area to be sodded.

3.02 QUALITY CONTROL

- A. Contractor quality control shall apply to all work in this Section in accordance with the provisions of Division I, General Requirements. Except where specifically testing, and approval shall be performed by the Contractor's quality control representative or a member of his staff. Where it is specified that a submission be made to others for approval, the CQC representative shall check the submission and satisfy himself that it complies with contract requirements prior to submission to others for approval.

3.03 CONTRACTOR'S RECORD OF CERTIFICATION

- A. Contractor's records of certification will be required for the following, and three copies each of all documentation shall be furnished the Owner for record purposes:
 - 1. Certificate of Conformance will be required for the following:
 - a. Sod
 - b. Fertilizer
 - c. Topsoil
 - d. Lime
 - 2. Test Reports: 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.

3.04 REQUEST FOR FINAL ACCEPTANCE

- A. The Contractor shall submit to the Owner or his Representative two copies of a written request for final acceptance of the grassing work. The request shall be submitted at least ten days prior to the anticipated date of acceptance. The condition of the grass will be noted, and the Contractor will be notified if maintenance is to continue.

3.05 GUARANTEE AND REPLACEMENT

- A. All sod shall be guaranteed for a period of thirty (30) days from the time of job acceptance.
- B. Replacement of sod necessary during the maintenance period shall be the responsibility of the Contractor, except for possible replacements of sod due to theft, vandalism, and neglect by Owner or acts of negligence on the part of others.
- C. At the end of the guaranty period, and at any time during the period, any sod that dies or is not in satisfactory condition, as determined by the Owner and the Landscape Architect, shall be removed and replaced with new, healthy material of the original. The new material shall be guaranteed as outlined above. The Landscape Contractor shall be responsible for the cost of the material and labor.
- D. The time limit may be extended by agreement for any material in questionable condition at the end of the guaranty period.

END OF SECTION

SECTION 03200 - CONCRETE REINFORCEMENT

PART 1 - GENERAL

1.01 DESCRIPTION

A. Scope of Work: The work included in this Section consists of providing reinforcing steel and welded wire mesh for cast-in-place or precast concrete structures.

B. Related Work:

1. Concrete Formwork: Section 03100
2. Cast-In-Place Concrete: Section 03300

1.02 QUALITY ASSURANCE

A. Standards: Unless otherwise indicated, all materials, workmanship and practices shall meet all requirements of the current editions of the following standards:

1. Standard Building Code.
2. ACI 318 Building Code Requirements for Reinforced Concrete.
3. ACI 315 Details and Detailing of Concrete Reinforcement.
4. CRSI Manual of Standard Practice, MSP-2.

1.03 SUBMITTALS

A. Complete shop drawings shall be submitted for approval, including bar lists and placing drawings. Drawings shall show the type, spacing and location of metal bar supports, the grade of the reinforcing and the name of the manufacturer. The type of coupler splice devices shall be designated.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Reinforcing Bars: ASTM A615, Grade 60, deformed bars of a USA manufacturer.
- B. Welded Wire Fabric: ASTM A185, galvanized.

C. Metal Bar Supports: CRSI MSP-2, Chapter 3, Class 2, Type B, Stainless Steel Protected Bar Supports.

D. Coupler Splice Devices: Cadweld, tension couplers capable of developing the ultimate strength of the bar, as manufactured by Erico Products, Incorporated, Solon, Ohio, or equal and where approved by the Engineer.

2.02 FABRICATION

A. Fabrication shall not begin until the approval of the shop drawings by the Engineer has been received. Fabrication shall meet all requirements of the specified standards. Unless otherwise indicated, the following shall apply:

1. Hooks shall be standard hooks.
2. Bottom bars shall extend a minimum of 6 inches into supporting members.
3. Cover is to the outermost stirrup, tie or bar.
4. Splices are permitted only where indicated on the Drawings.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Supporting Reinforcing: Bar supports shall be provided as required by CRSI MSP-2 and AC1315. Top and bottom bars in slabs formed on earth shall be supported on precast concrete block supports except where such bars are properly supported from formwork. Precast concrete block supports are not required in slabs formed on tremie concrete but may be used at the Contractor's option.

B. Placing Reinforcing: Placing of reinforcing and welded wire fabric shall be as indicated on the Drawings and as recommended by CRSI MSP-2 and ACI 315. Reinforcing shall be securely tied and supported to prevent displacement during concrete placement.

C. Welded Wire Fabric: Splices in welded wire fabric shall be such that the overlap between outermost cross wires of each fabric sheet is not less than the spacing of the cross wires, plus 2 inches. Fabric shall not be extended through expansion joints or construction joints in slabs on grade except as otherwise indicated.

D. Coupler Splice: Unless indicated on the Drawings or where conventional lap splices cannot be achieved, full positive tension connections shall be provided. Such devices shall be installed in accordance with the recommendations of the manufacturer.

- E. Dowels: Dowels shall be wired in position prior to placing concrete.
- F. Field Bending: Heat shall not be used to bend bars. Bars shall not be bent after being embedded in concrete.
- G. Welding: Welding of reinforcing will not be permitted.
- H. Place reinforcement a minimum of 2 inches clear of any metal pipe or fittings.

END OF SECTION

SECTION 02820 – WATER PIPES, VALVES AND APPURTENANCES

PART 1 – GENERAL

1.01 SCOPE OF WORK

- A. These specifications cover the pipes, fittings and appurtenances used for water distribution systems.
- B. The CONTRACTOR shall replace, at his expense, all materials found to be defective or damaged in handling or storage. The CONTRACTOR shall, if requested by UTILITIES, furnish certificates, affidavits of compliance, test reports, or samples for analysis for any of the materials specified herein. All pipe delivered to project site for installation is subject to random testing for compliance with the designated specifications.
- C. Pipe and fitting interior linings shall conform to ANSI/NSF 61 list of approved materials standard.

PART 2 – PRODUCTS

2.01 PIPE MATERIALS

A. PVC Pipe:

PVC water distribution mains shall be manufactured in accordance with AWWA standard C900 or C909, latest edition. Pipe shall have a minimum pressure rating of 150 psi and have a maximum dimension ratio of 18. Pipe shall be blue in color.

B. Ductile Iron Pipe:

Ductile iron pipe shall conform to ANSI/AWWA A21.51/C151. Pipe shall be pressure class of 350 for pipe 4 to 12 inches in diameter. Pipes 16 to 24 inches in diameter shall be pressure class 250. Pipes 30 to 64 inches in diameter shall be pressure class 200. Pipe shall be color coded blue with tape. The tape (min 2”) shall be permanently affixed to the top and each side of the pipe (three locations parallel to the axis of the pipe). For pipes less than 24 inches in diameter, a single tape may be used along the top of the pipe.

C. HDPE Pipe:

HDPE pipe shall be in accordance with AWWA C906 and shall have an outside diameter equal to ductile iron pipe for the same size. Pipe shall have a minimum dimension ratio of 11 for use with ductile iron pipe fittings and have a working pressure of 150 psi.

2.02 JOINT MATERIALS

A. PVC Pipe Joints:

PVC pipe shall have integral bell push on type joints conforming to ASTM D3139.

B. Ductile Iron Pipe Joints:

Joints for ductile iron pipe shall be push-on or mechanical joints conforming to ANSI/AWWA A21.11/C111., Restrained or flanged joints shall be provided where Orange County Utilities STANDARDS AND CONSTRUCTION SPECIFICATIONS MANUAL called for in the PLANS. Flanged points shall conform to ANSI Standard B 16.1-125 pounds.

C. HDPE Pipe Joints:

HDPE joints shall conform to AWWA C906.

2.03 FITTINGS

A. Ductile Iron and PVC Pipe:

Fittings shall be in accordance with Section 3114 Installation of Pipe. All potable water main fittings shall have NSF 61 certification, and ISO 9001 certification for both the foundry and manufacturer. The NSF 61 certification shall be issued on all coatings and linings, from the said manufacturers that are used for potable water applications.

B. HDPE Pipe:

1. HDPE mechanical joint adapter shall be joined to the HDPE pipe by butt fusion. HDPE mechanical joint adapter shall be molded or fabricated conforming to AWWA C906. Molded fittings shall conform to ASTM D2683 for socket-type fittings, ASTM D3261 for butt-type fittings or ASTM F1055 for electro fusion type fittings.

2. On a case by case basis as approved by the COUNTY, mechanical bolt-on fittings may be used as an alternative to butt fusion adapters. Stainless steel pipe stiffeners shall be installed for internal circumferential support of the pipe ends when mechanical bolt-on fittings are used.

2.04 COATINGS AND LININGS FOR DUCTILE IRON PIPE AND FITTINGS

A. Fittings

Ductile iron fittings shall have fusion-bonded epoxy coating in accordance with ANSI/AWWA C116 or cement-mortar with a seal coat in accordance with ANSI/AWWA A21.4/C104. Fusion-bonded epoxy shall be holiday free and tested in accordance with ASTM G62 method A or method B. Testing method at the discretion of the applicator. Any holidays indicated by the detector shall be repaired in accordance with the manufacturer's repair procedures.

B. Pipe

Ductile iron pipe shall have an interior protective lining of cement-mortar with a seal coat of asphaltic material in accordance with ANSI/AWWA A21.4/C104. Exterior ductile iron pipe shall be coated with asphaltic material in accordance with a minimum one mil thick in accordance with ANSI/AWWA A21.51/C151 for below ground piping only.

C. Additional Applied Exterior Coatings for Above Ground Pipe and Fittings

Pipe, fittings and valves for above ground applications shall be accordance with the Section 3119 Coatings and Linings Primer and field coats shall be compatible and Orange County Utilities

shall be applied in accordance with the manufacturer's recommendations. Refer to Appendix D, "List of Approved Products". Final field coat shall be blue for finished water. Asphaltic seal coat applied to the exterior of above ground piping / fittings shall be blasted and completely removed prior to coating per Section 3119 Coatings and Linings..

2.05 POLYETHYLENE ENCASEMENT

A. Polyethylene encasement shall be in accordance with ANSI/AWWA A21.51/C105, wrapping colors to be blue. Polyethylene encasements are required in accordance with AWWA C105 and when crossing, or adjacent to, power easements, gas easements, any location where induced currents may be present and in areas where aggressive soils exist

2.06 SERVICE PIPE, STOPS, FITTINGS, AND SERVICE SADDLES

A. Service Connections at Main:

1. One-inch service connections shall be brass body reduced port type corporation stops, equipped with connections compatible with the polyethylene tubing and threaded in accordance with specifications in AWWA C800, AWWA C901 and shall comply with NSF-61.

2. Service connections, 2-inch through 12-inch, shall be iron body resilient seat gate valves. Two-inch services at the water main shall have connections for female iron pipe by female iron pipe thread, conforming to AWWA C509.

3. Service taps for air release valve installations shall utilize a 2-inch brass ball type corporation stop.

B. Service Pipe:

1. One-inch and two-inch service lines shall be blue polyethylene tubing, conforming to specifications in AWWA C800, SDR 9 and AWWA C901.

2. Services 4-inch and larger shall be DIP from the point of connection to the existing main to the meter assembly, if the existing main is on the same side of the street as the property. If the existing main is on the opposite side of the street, as a minimum, the segment of the pipe immediately upstream from the meter assembly shall be DIP.

C. Service Control Valves:

D.

1. One-inch and two-inch size service control valves shall be reduced port ball valves, made of brass, cast and machined in accordance with specifications in AWWA C800, AWWA C901, compliant with NSF-61 and compatible polyethylene tubing connections.

2. For metered connections four-inch and greater, UTILITIES shall provide the valves with the meter.

3. For non-metered connections four-inch and greater, the CONTRACTOR shall provide resilient seat OS&Y gate valves.

D. Service Fittings:

1. One-inch and two-inch fittings shall be brass, cast and machined in accordance with specifications in AWWA C800, AWWA C901, compliant with NSF-61 with compatible polyethylene tubing connections.
2. Fittings, 4, 6, 8 and 12 inches in size shall be the same as water main fittings, as per this Section.

E. Service Tapping Saddles:

1. Stainless Steel Service Saddles:

Epoxy or nylon coated ductile iron body with stainless steel, 18-8 type 304 straps, AWWA tapered threads for 1-inch and two-inches to be iron pipe threads. Controlled OD saddles to be used on C905 PVC pipe, double straps to be 2-inch minimum width each, single strap to be minimum of three inches wide.

2. Service Connections:

a. PVC Pipe Service Saddle:

- i. One-inch and two-inch services utilize brass body saddle with controlled OD for 12-inches and smaller pipe.
- ii. One-inch and two-inch taps on existing pipes larger than 12-inches shall use controlled OD epoxy or nylon coated ductile iron body with stainless steel 18-8 type 304 straps.
- iii. Four-inch or larger services shall be mechanical tapping sleeves.

b. Ductile Iron Pipe Service Saddle:

- i. One-inch services shall be direct tapped.
- ii. Two-inch services shall use a controlled OD service tapping saddle with stainless steel straps and a ductile iron body that is either nylon or epoxy coated.
- iii. Four-inch or larger services shall be mechanical tapping sleeves.

c. Concrete Pressure Pipe Service Saddle:

- i. Tapped concrete pressure pipe shall be in accordance with AWWA M-9, using a strap-type saddle made specifically for concrete cylinder pressure pipe.

d. HDPE Pipe Service Saddle:

- i. One-inch and two-inch shall utilize controlled O.D. tapping saddle with epoxy or nylon coated stainless steel 18-8-type 304 double straps, Taps to HDPE pipe shall be approved on a case by case basis.
- ii. Taps, 4-inch and larger, shall use wide body tapping sleeves with a broad cross section gasket set in a retaining groove that increases sealing capability as pressure increases.

e. Steel Pipe Service Saddle:

Welded-on steel sleeves shall be used for all sizes and applications.

2.07 RESILIENT SEAT GATE VALVES

A. Gate valves shall be resilient seat gate valves, manufactured to meet or exceed the requirements of AWWA C509 / C515, latest revision, and in accordance with these specifications. Valves shall have an unobstructed waterway equal to or greater than the full nominal diameter of the valve. Valves shall have a minimum pressure rating of 250 psi.

B. Gate valves shall be installed vertically per the design drawings and with minimum depth of cover per Table 2210-1. Vertical valves 16" and larger shall be AWWA C515 resilient seated only (16" and 24" no gearing required) above 24" shall be installed vertically with a spur gear actuator unless noted by the engineer. The valve body, bonnet and bonnet cover shall be ductile iron ASTM A536. All ferrous surfaces inside and outside shall have a fusion-bonded epoxy coating in accordance with AWWA C 550. A two-inch wrench nut shall be provided for operating the valve. All valves are to be tested in strict accordance with AWWA C515.

C. Directional Opening:

All valves shall open left or counter clockwise.

D. The valves shall be non-rising stems with the stem made of cast, forged, or rolled bronze as specified in AWWA C509. Two stem seals shall be provided and shall be of the oring type. The stem nut must be independent of the gate.

E. The resilient sealing mechanism shall provide zero leakage at test and normal working pressure when installed with the line flow from either direction.

F. Tapping Valves with Alignment Lip shall be placed vertical where possible for Water & Reclaimed Water. Tapping Valves 16" and larger AWWA C515 resilient seated only (16" and 24" no gearing required) above 24" shall be installed vertically with a spur gear actuator unless noted by the engineer. When tapping existing mains, valves 24" and above shall be furnished with NPT pipe plugs for flushing the tracks.

2.08 BUTTERFLY VALVES

A. Valves 42 inches and larger may be butterfly valves, as approved by UTILITIES. Butterfly valves and operators shall conform to the "AWWA Standard Specifications for Rubber Seated Butterfly Valves", Designation C504, latest version, except as hereinafter specified, shall be Class 150.

B. The valve body materials shall be epoxy coated inside and out per AWWA C550. The valve body shall be constructed of close grain cast iron per ASTM A126, Class B or equivalent material. All retaining segments and adjusting devices shall be of corrosion resistant material. Valves shall have the manufacturer's name and valve rating cast in body

C. Valve seats shall be EPDM. Valve seats shall be field adjustable and replaceable without dismantling operator disc or shaft and without removing the valve from the line. All retaining segments and adjusting devices shall be of corrosion resistant material. Valve seats shall be designed to be leak-tight in both directions at differential pressures up to, and including, the rated pressure of the valve class.

D. Valve disc shall be designed to withstand full differential pressures across the closed valve disc without exceeding a stress level equivalent to one fifth of the tensile strength of the material.

E. The face-to-face dimensions of valves shall be in accordance with above-mentioned AWWA specification for short-body valve.

F. The valve shaft shall be turned, ground and polished constructed of 18-8 stainless steel and designed for both torsional and shearing stresses when the valve is operated under its greatest dynamic or seating torque. Shaft shall be of either a one-piece unit extending full size through the valve disc and valve bearing or it may be of a stub shaft design.

G. Valve Actuator:

H. Actuators shall be designed for input torques based on 150 psi valve pressure and 16 ft/s. velocity with a maximum input of 80 ft-lb on 2" nuts and shall withstand 250 ft-lbs. In general, the butterfly valve actuators shall conform to the requirements of AWWA standard specifications for "Rubber Seated Butterfly Valves, Designation C504", insofar as applicable. All valve and actuators, shall be installed, adjusted, and tested as an assembly by the valve manufacturer at the manufacturing plant. An affidavit of compliance signed by the actuator manufacturer shall be required stating the provisions of ANSI/AWWA C504 have been met. The rated torque capability of each actuator shall be sufficient to seat, unseat, and rigidly hold, in any intermediate position, the valve disc it controls. Directional opening and Extension Stem All valves shall open left or counterclockwise and a ground level position indicator and extension stem / shaft for the 2" nut shall be provided for buried valves.

2.09 VALVE BOXES

A. Standard Two-Piece Cast Iron Valve Box:

Cast-iron two-piece valve boxes are required for mains less than six feet below finished grade and less than or equal to 12 inches in diameter. Valve boxes shall be provided with suitable heavy bonnets and shall extend to such elevation at or slightly above the finished grade surface as directed by UTILITIES. The barrel shall be screw type only, having 5-1/4-inch shaft. The upper section shall have a flange at the bottom having sufficient bearing area to prevent settling and shall be complete with Locking cast iron covers. Covers shall have "WATER" cast into the top for all water mains.

B. Valve Box Assembly:

Valve box assemblies are required for any size main that is six feet or greater below finished grade or if mains are greater than 12 inches in diameter. Valve boxes shall be one complete assembled unit composed of the valve box and extension stem that attaches and locks to the two-inch wrench nut. All moving parts of the extension stem shall be enclosed in a housing to prevent contact with the soil. A valve box centering device designed to eliminate the shifting of the valve box against the operating nut of the valve shall be used. Valve box assembly shall be adjustable to accommodate variable trench depths six feet and greater as shown in the STANDARD DRAWINGS.

C. Valve box insert shall be one complete assembled unit with a self-adjusting extension stem system that fits inside a standard valve box that will accommodate variable trench depths six-feet and greater as shown in the STANDARD DRAWINGS.

D. Valve boxes shall have locking lids utilizing a five sided nut with a special wrench needed to open. Valve lids to be made as shown in the STANDARD DRAWINGS.

E. Valve collars shall be 24" X 24" round or square and poured in place with 3000psi concrete or made out of a fiberglass re-enforced concrete polymer material manufactured to the specifications as shown in the STANDARD DRAWINGS.

F. Locating wire shall be 10-gauge single strand solid core copper wire with insulation. The color of the insulation shall be the same color as the color code for the pipe being installed.

G. Valve markers are to be made of schedule 80 PVC and have a decal applied containing information as shown in the STANDARD DRAWINGS. The marker must be the same color as the pipe being marked.

2.10 AIR RELEASE VALVES

A. The air release valves for use in water mains shall be single body combination air release valves designed to release large quantities of air at start up, admit air on shut down and release air in operation. Air release valves shall be 316 stainless steel, , 316 stainless steel float, bronze water diffuser Buna-N or Viton seat and stainless steel trim. Air release valves must be in stalled in an enclosure as shown on the STANDARD DRAWINGS. Fittings from the main to the air release valve in the enclosure shall be threaded and made of brass.

2.11 FIRE HYDRANTS

A. General:

B. Fire hydrants shall have a minimum of 5-1/4-inch valve opening and shall comply with AWWA Standard C502 for fire hydrants for water works service, unless in conflict with this MANUAL, in which case this MANUAL shall apply. Each hydrant shall have 6-inch mechanical joint ends and shall open by turning to the left (counter-clockwise). Fire hydrants shall be of ample length for bury of 30 inches, to match main installation. Hydrants shall be provided with two 2-1/2-inch hose nozzles and one, 4-1/2-inch pumper nozzle, all having National Standard hose threads. Nozzles shall have caps attached by chains. Operating nuts shall be AWWA Standard pentagonal, measuring 1-1/2-inch point to flat. Fire hydrants shall be equipped with o-ring packing. Fire hydrants shall be supplied without drain holes or with permanently plugged drain holes.

B. Coating and painting:

All non-brass parts of the hydrant both inside and outside shall be painted, in accordance with AWWA C-502. The shoe of the hydrant below the ground line shall have a fusion bonded epoxy coating and the barrel of the hydrant below ground shall be coated with amastic material by the manufacturer. The above ground portion of the hydrant shall be coated in accordance with

Section 3119 Coatings & Linings. The paint used shall be from the manufacturers and type as listed in Appendix D, "List of Approved Products".

PART 3 - EXECUTION

3.01 MATERIAL IDENTIFICATION AND TESTING

A. Pipe Identification:

1. Each length of pipe shall bear the name or trademark of the manufacturer, the location of the manufacturing plant, and the class or strength classification of the pipe. The markings shall be plainly visible on the pipe barrel. Pipe, which is not clearly marked, is subject to rejection. The CONTRACTOR shall remove all rejected pipe from the project site within five NORMAL WORKING DAYS.
2. All pipe not factory color-coded shall have a field applied, three inch wide blue stripe down the length of the pipe.

B. Material Testing Requirements:

1. If requested by UTILITIES, a sample of pipe to be tested shall be selected at random by UTILITIES or the testing laboratory hired by UTILITIES.
2. When the samples tested conform to applicable standards, all pipe represented by such samples shall be considered acceptable based on the test parameters measured. Copies of test reports shall be available before the pipe is installed on the project.
3. In the event that any of the test samples fail to meet the applicable standards, all pipe represented by such tests shall be subjected to rejection. The CONTRACTOR may furnish two additional test samples from the same shipment or delivery, for each sample that failed and the pipe will be considered acceptable if all of these additional samples meet the requirements of the applicable standards. All such retesting shall be at the CONTRACTOR's expense.
4. Pipe that has been rejected by UTILITIES shall be removed from the site of the work by the CONTRACTOR and replaced with pipe that meets these specifications.

END OF SECTION

SECTION 03300 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.01 DESCRIPTION

A. Scope of Work: The work included in this Section consists of providing cast-in-place concrete.

B. Related Work Described Elsewhere:

1. Concrete Formwork: Section 03100

2. Concrete Reinforcement: Section 03200

1.02 QUALITY ASSURANCE

A. Standards: Unless otherwise indicated, all materials, workmanship and practices shall conform to the requirements of the following standards:

1. Standard Building Code, 2010 Florida Building Code, or latest edition

2. Local Codes and Regulations

3. ACI 318-83, Building Code Requirements for Reinforced Concrete

B. Plant Qualification: Plant equipment and facilities shall meet all requirements of the Check List for Certification of Ready Mixed Concrete Production Facilities of the National ready Mixed Concrete Association and ASTM C 94.

C. Evaluation and Acceptance of Concrete: Evaluation and acceptance of concrete will be in accordance with ACI-318, Chapter 4.

1.03 SUBMITTALS

A. Materials and Shop Drawings: The following information shall be submitted for approval. No concrete shall be furnished until submittal has been approved.

1. Plant Qualification: Satisfactory evidence shall be submitted indicating

2. Materials: Satisfactory evidence shall be submitted indicating that materials to be used, including cement, aggregates and admixtures meet the specified requirements.

3. Design Mix: The design mix to be used shall be prepared by qualified persons and submitted for approval. Submit affidavit as to design mix performance over the preceding six

months. The design of the mix is the responsibility of the Contractor subject to the limitations of the Specifications. Approval of this submission will be required only as minimum requirements of the Specifications have been met. Such approval will in no way alter the responsibility of the contractor to furnish concrete meeting the requirements of the Specifications relative to strength and slump.

4. Ready Mix Concrete: Provide delivery tickets or weighmasters certificate per ASTM C 94, including weights of cement and each size aggregate, amount of water in the aggregate, and amount of water added at the plant. Write in the amount of water added on the job. Retain all delivery tickets and turn in to Owner as part of closeout documents.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Cement:

1. Cement for all concrete shall be domestic Portland cement that conforms to the requirements of ASTM Designation C 150 Type I, Type II or Type III. All sanitary sewer manholes, wet wells, pumping stations, tanks and structures exposed to wastewater shall be constructed with Type II cement. Type III cement for high early strength concrete shall be used only for special locations and only with the approval of the Engineer. Type I cement may be used for buildings and tremie concrete.

2. Only one brand of cement shall be used in any individual structure unless approved by the Engineer. Cement which has become damaged, partially set, lumpy or caked shall not be used and the entire contents of the sack or container which contains such cement will be rejected. No salvaged or reclaimed cement shall be used.

3. Fly Ash shall not be used in either Class A or Class B concrete.

B. Aggregates:

1. ASTM C 33. Coarse aggregates shall be size No. 57. Block cell fill shall be size No. 89.

2. In addition to requirements of ASTM C 33 for structures exposed to wastewater, the following shall apply:

- a. Soft particles: 2.0 percent
- b. Chert as a soft impurity (defined in Table 3 of ASTM C 33): 1.0 percent
- c. Total of soft particles and chert as a soft impurity: 2.0 percent
- d. Flat and elongated particles (long dimension more than 5 times short dimension): 15.0 percent

- C. Water: Clean and free from injurious amounts of deleterious materials.
- D. Air Entraining Admixture: ASTM C 260.
- E. Water Reducing and Retarding Admixture: ASTM C 494, Type D. Admixture shall not contain calcium chloride.
- F. Epoxy Bonding Agent: Sikastix 370, Sikadur Hi Mod, Concresive 1001-LPL or approved equal.

2.02 MIXES

A. General Requirements:

- 1. Mix Design: Proportioning shall be on the basis of field experience and/or trial mixtures as specified in ACI 318, Section 4.3. Data on consecutive compression tests and standard deviation shall be submitted. Proportioning for small structures may be by the water/cement ratio under special approval by the Engineer. Concrete mix design shall comply with the Standard Building Code requirements.
- 2. Air Content: 5 percent plus or minus 1 percent (Class A and B).
- 3. Slump: 4 inches plus or minus 1 inch.
8 inches plus or minus 1 inch for tremie concrete.
- 4. Water cement ratio = 0.45 maximum (all concrete exposed to hydrostatic loading), 0.50 maximum (all other concrete).
- 5. Minimum Compressive Strength at 28 days:
 - a. Class A, 4,000 psi Wastewater structures inclusive of tanks, ditches, pumping stations, tremie concrete and other structures in contact with treated waters.
 - b. Class B, 3,000 psi Building structures, encasements, thrust blocks, and pipe supports, etc. not in contact with treated waters.

B. Production of Concrete:

- 1. General: Concrete shall be ready mixed and shall be batched, mixed and transported in accordance with ASTM C 94, except as otherwise indicated.
- 2. Air Entraining Admixture: Air entraining admixture shall be charged into the mixture as a solution and shall be measured by means of an approved mechanical dispensing device. The liquid shall be considered a part of the mixing water.

3. Water Reducing and Retarding Admixture: Water reducing and retarding admixture shall be added and measured as recommended by the manufacturer. The addition of the admixture shall be separate from the air entraining admixture. The addition of the admixture shall be completed within one minute after addition of water to the cement has been completed, or prior to the beginning of the last three-quarters of the required mixing, whichever occurs first. Admixtures shall be stored, handled and batched in accordance with the recommendations of ACI 68.

C. Delivery Tickets: In addition to the information required by ASTM C 94, delivery tickets shall indicate the cement content and the water/cement ratio.

D. Temperatures: The temperature of the concrete upon delivery from the truck shall not exceed 90°F.

E. Modifications To The Mix: No modifications to the mix shall be made in the plant or on the job which will decrease the cement content or increase the water-cement ratio beyond that specified. No modifications of any kind shall be made except by a qualified and responsible representative of the concrete producer.

PART 3 - EXECUTION

3.01 PREPARATION

A. Preparations Before Placing: No concrete shall be placed until the approval of the Engineer has been received. Approval will not be granted until forms are thoroughly clean, and reinforcing and all other items required to be set in concrete have been placed and thoroughly secured. The Engineer shall be notified a minimum of 24 hours before concrete is placed.

B. Conveying:

1. General: Concrete shall be handled from the truck to the place of final deposit as rapidly as practicable by methods which will prevent segregation or loss of ingredients to maintain the quality of the concrete. No concrete shall be placed more than 90 minutes after mixing has begun for that particular batch.

2. Buckets and Hoppers: Buckets and hoppers shall have discharge gates with a clear opening equal to no less than one-third of the maximum interior horizontal area, or five times the maximum aggregate size being used. Side slopes shall be no less than 60 degrees. Controls on gates shall permit opening and closing during the discharge cycle.

3. Runways: Extreme care shall be exercised to avoid displacement of reinforcing during the placing of concrete.

4. Elephant Trunks: Hoppers and elephant trunks shall be used to prevent the free fall of concrete for more than 6 feet.
5. Chutes: Chutes shall be metal or metal lined, and shall have a slope not exceeding one vertical to two horizontal, and not less than one vertical to three horizontal. Chutes more than 20 feet long and chutes not meeting the slope requirements, may be used only if they discharge into a hopper before distribution.
6. Pumping Equipment: Pumping equipment and procedures, if used, shall conform to the recommendations contained in the report of ACI Committee 304 on "Placing Concrete by Pumping Methods," ACI 304.2R-71. The specified slump shall be measured at the point of discharge. The loss of slump in pumping shall not exceed 1-1/2 inches.
7. Conveying equipment Construction: Aluminum or aluminum alloy pipe for tremies or pump lines and chutes, except for short lengths at the truck mixer shall not be permitted.
8. Cleaning: Conveying equipment shall be cleaned at the end of each concrete operation.

3.02 APPLICATION

A. Placing:

1. General: Concrete shall be deposited continuously, or in layers of such thickness (not exceeding 2 feet in depth) that no concrete will be deposited on concrete that has hardened sufficiently to cause the formation of seams or planes of weakness.
2. Supported Elements: At least two hours shall elapse after depositing concrete in columns or walls before depositing in beams, girders, or slabs supported thereon.
3. Segregation: Concrete shall be deposited as nearly as practicable in its final position to avoid segregation due to rehandling or flowing. Concrete shall not be subjected to procedures which will cause segregation.
4. Concrete Under Water: All concrete, except that indicated on the Drawings as Tremie concrete, shall be placed in the dry.

B. Seals and Tremie Concrete:

1. General:

- a. Wherever practicable, all foundation excavations shall be dewatered and the concrete deposited in the dry. Where conditions are encountered which render it impracticable to dewater the foundation before placing concrete, a concrete foundation seal shall be placed. The foundation shall then be dewatered, and the balance of the concrete placed in the dry.

b. When seal concrete is required to be placed, the satisfactory performance of the seal in providing a watertight excavation for placing structural concrete shall be the responsibility of the Contractor. Seal concrete placed by the Contractor, which subsequently fails to perform properly, shall be repaired as necessary to perform its required function, at the expense of the Contractor.

2. Method of Placing: Concrete deposited under water shall be carefully placed in the space in which it is to remain by means of a tremie, a closed-bottom dump bucket of not less than one cubic yard capacity, or other approved method, and shall not be disturbed after it is deposited. All seal concrete shall be deposited in one continuous pour. No concrete shall be placed in running water. All form work designed to retain concrete under water shall be watertight, and the design of the form work and excavation sheeting shall be by a Professional Engineer, registered in the State of Florida.

3. Use of Tremie: The tremie shall consist of a tube having a minimum inside diameter of ten inches, and shall be constructed in sections having tight joints. No aluminum parts which have contact with the concrete will be permitted. The discharge end shall be entirely seated at all times, and the tremie tube kept full to the bottom of the hopper. When a batch is dumped into the hopper, the tremie shall be slightly raised (but not out of the concrete at the bottom) until the batch discharges to the bottom of the hopper, after which the flow shall be stopped by lowering the tremie. The means of supporting the tremie shall be such as to permit the free movement of the discharge end over the entire top surface of the work, and shall permit it being lowered rapidly when necessary to choke off or retard the flow. The flow shall preferably be continuous, and in no case shall be interrupted until the work is completed. Special care shall be exercised to maintain still water at the point of deposit.

4. Use of Bottom-dump Bucket: When the concrete is placed by means of a bottom-dump bucket, the bucket shall be lowered gradually and carefully until it rests upon the concrete already placed. The bucket shall then be raised very slowly during the discharge travel; the intent being to maintain, as nearly as possible, still water at the point of discharge and to avoid agitating the mixture. Aluminum buckets will not be permitted.

5. Time of Beginning Pumping: Pumping to dewater a sealed cofferdam shall not commence until the seal has set sufficiently to withstand the hydrostatic pressure, and in no case earlier than 72 hours after placement of the concrete.

C. Consolidating Concrete:

1. General: Concrete shall be consolidated by means of internal vibrators operated by competent workmen.

2. Vibrators: Vibrators shall have a minimum head diameter of at least 2 inches, a minimum centrifugal force of 700 pounds and a minimum frequency of 8,000 vibrators per second.

3. Vibrators for Confined Areas: In confined areas, the specified vibrators shall be supplemented by others having a minimum head diameter of 1-1/2 inches, a minimum centrifugal force of 300 pounds and a minimum frequency of 9,000 vibrations per second.
 4. Spare Vibrator: One spare vibrator for each three in use shall be kept on the site during all concrete placing operations.
 5. Use of Vibrators: Vibrators shall be inserted and withdrawn at points approximately 18 inches apart. The duration of each insertion shall be from 5 to 15 seconds. Concrete shall not be transported in the forms by means of vibrators.
- D. Protection: Rainwater shall not be allowed to increase the mixing water, nor to damage the surface finish. Concrete shall be protected from construction overloads. Design loads shall not be applied until the specified strength has been attained.

3.03 CONCRETE FINISHING AND CURING

- A. All slabs exposed to view shall receive a steel trowel finish without local depressions or high points and apply a light hair-broom finish. Do not use stiff bristle brooms or brushes. Leave hair-broom lines parallel to the direction of slab drainage.
- B. All other slabs and footings shall receive a smooth steel trowel finish.
- C. All walls of structures or parts of buildings exposed to view shall receive the following finish. Repair defective concrete, remove fins, fill depressions 1/4-inch or deeper, and fill tie holes. In addition, any surface not receiving a special applied finish, shall receive a slurry finish consisting of one part cement and one and one-half parts sand by damp loose volume. Dampen surfaces and then apply the slurry with clean burlap pads or sponge rubber floats. Remove any surplus by scraping and then rubbing with clean burlap. Surfaces which will receive a special applied finish shall be of even color, have no pits, pockets, holes, or sharp changes of surface elevation. Scrubbing with a stiff bristle fiber brush shall produce no dusting or dislodging of cement or sand.
- D. All concrete shall be wet cured a minimum of 7 days; or if not to receive special finishes, coatings or concrete toppings, an Engineer approved curing compound may be utilized.
- E. All surface defects shall be repaired by removing defective concrete down to sound concrete and repairing with patching mortar. Finished repair shall match adjacent concrete and be cured as specified.

3.04 TESTING

- A. A testing laboratory approved by the Owner will make such tests as are deemed advisable. The Contractor shall pay for all tests indicating a failure to comply with the Specifications. The Contractor shall keep the laboratory informed of his schedule.

B. Standard laboratory compressive test cylinders will be obtained by the laboratory when concrete is discharged at the point of placing (i.e., discharge end of pumping equipment), and cylinders will be made and cured in accordance with the requirements of ASTM Designation C 31. A set of 4 cylinders will be obtained for each 50 cubic yards or fraction thereof placed each day, for each type of concrete. The cylinders will be cured under laboratory conditions and will be tested at 7 and 28 days of age, respectively, in accordance with the requirements of ASTM Designation C 39.

C. The testing laboratory will make slump tests of Class A and Class B concrete as it is discharged from the mixer at the point of placing. Slump tests will be made for each 25 cubic yards or "pour" of concrete placed. Slump tests may be made on any batch, and failure to meet specified slump requirements will be sufficient cause for rejection of that batch.

END OF SECTION

SECTION 03310 – WASTEWATER PIPES, VALVES AND APPURTENANCES

PART 1 – GENERAL

1.01 SCOPE OF WORK

A. These specifications cover wastewater pipes, valves and appurtenances used for the wastewater collection and pumping systems.

B. The CONTRACTOR shall be responsible for all stored material furnished for the project. The CONTRACTOR shall, if requested by UTILITIES, furnish certificates, affidavits of compliance, test reports or samples for any of the materials specified herein. All materials delivered to project site for installation are subject to random testing for compliance with the designated specifications.

PART 2 - PRODUCTS

2.01 PIPE MATERIALS

A. PVC Gravity Pipe and Fittings:

1. PVC gravity pipe (6-inch to 15-inch), shall conform to ASTM D3034, maximum SDR 35. Uniform minimum “pipe stiffness” at five percent deflection shall be 46 psi. The joints shall be integral bell elastomeric gasket joints manufactured in accordance with ASTM D3212 and ASTM F477. Applicable UNI-Bell Plastic Pipe Association standard is UNI-B-4.

2. PVC gravity pipe (18-inch to 30-inch), shall conform to ASTM F679, maximum SDR 35. Uniform minimum “pipe stiffness” at five percent deflection shall be 46 psi. The joints shall be integral bell elastomeric gasket joints manufactured in accordance with ASTM D3212 and ASTM F477. Applicable UNI-Bell Plastic Pipe Association standard is UNI-B-7.

3. All PVC pipe shall bear the NSF-DW seal. The minimum standard length of pipe shall be 13 feet.

4. Joints:

PVC gravity pipe joints shall be flexible elastomeric seals per ASTM D 3212.

5. Fittings:

Unless otherwise specified, wye branches shall be provided in the gravity main for service lateral connections. Wyes shall be six inches inside diameter. All fittings shall be of the same material as the pipe.

6. Plugs for stub outs shall be of the same material as the pipe, and gasketed with the same gasket material as the pipe joint, or be of material approved by UTILITIES. The plug shall be secured to withstand specified test pressures.

7. Locator balls shall be placed under all sanitary sewer service cleanouts.

B. PVC Pressure Pipe and Fittings:

1. All PVC pipe of nominal diameter 4 to 12 inches shall be manufactured in accordance with AWWA Standard C900 and greater than 12 inches shall be manufactured in accordance with AWWA Standard C905. The PVC pipe shall have a minimum working pressure rating of 100 psi and shall have a maximum dimension ratio of 18. Pipe shall be the same outside diameter as ductile iron pipe.

2. Joints:

PVC pipe shall have integral bell push on type joints conforming to ASTM D3139.

3. Fittings:

Fittings shall be restrained mechanical joint ductile iron or gray iron conforming to ANSI/AWWA A21.10/C110, 250 psi minimum pressure rating, or ANSI/AWWA A21.53/C153. Interior and exterior coatings of ductile iron pipe fittings shall be as specified in Appendix D, "List of Approved Products".

4. Restrained Joints:

Restrained joint devices shall be made specifically for PVC pipe and meet or exceed the requirements in ASTM F-1674.

C. Joints for Dissimilar Pipe:

Joining of dissimilar pipe and pipe between pump station wet well and valve vault shall conform to the following table.

Table 3310-1. Joints for Dissimilar Pipe.

Type of Line	Material	Material	Use
Gravity	C-900	SDR-35	PVC Adapter
Force Main	PVC	Ductile iron	Restrained J Sleeve
Force Main	PVC	HDPE	Restrained MJ Sleeve To Fused HDPE Adapter
Force Main	PVC	AC	Coupler
Pump Station Wet Well to Valve Box	Ductile iron	Ductile iron	MJ Sleeve

D. Pipe Markings:

Pipes shall have a manufacturer's home-mark on the spigot. On field cut pipe, the CONTRACTOR shall provide home-mark on the spigot in accordance with manufacturers recommendations.

E. Ductile Iron Pipe and Fittings for Pump Stations (pump discharge through valve vault):

1. Ductile Iron Pipe:

Ductile iron pipe of nominal diameter 4 through 54 inches shall conform to ANSI/AWWA A21.51/C151. A minimum of Class 200 pipe shall be supplied for all sizes of pipe unless a higher-class pipe is specifically called out in the PLANS or required by UTILITIES.

2. Fittings:

Shall be in accordance with Section 3114 Installation of Pipe.

3. Joints:

Joints shall be flanged conforming to ANSI/AWWA A21.11/C111, unless otherwise called for on the PLANS. Restrained or flanged joints shall be provided where called for on the PLANS. Flanged joints shall conform to ANSI Standard B16.1-125 LB.

4. Exterior Coatings:

Ductile iron pipe and fittings shall be coated as specified in Appendix D, "List of Approved Products". Primer and field coats shall be compatible and shall be applied in accordance with the manufacturer's recommendations. Final field coat color shall be green for wastewater. Exterior coatings in pipe or fittings above grade or in pump station shall be holiday free and holiday tested in accordance with ASTM G-62 and ASTM D5262. Asphaltic seal coat applied to the exterior of above ground piping / fittings shall be blasted and completely removed prior to coating per Section 3119 Coatings and Linings.

5. Interior Coatings and Linings:

Ductile iron pipe and fittings shall have an interior protective coating of Protecto 401 in accordance with the manufacturers recommendations and per Section 3119 Coatings and Linings. . Interior coating shall be holiday free and holiday tested in accordance with ASTM G-62 and ASTM D5162.

F. HDPE Pipe and Fittings:

1. HDPE Pipe:

Materials used for the manufacture of high-density polyethylene pipe and fittings shall comply with all requirements of ASTM D1248 and Plastic Pipe Institute (PPI) designation PE3408. Manufacturer shall be a member in good standing of the Plastic Pipe Institute. HDPE pipe and fittings shall comply or exceed AWWA Standards C901/C906, ASTM D2513, ASTM D3035 and ASTM F714. The manufacturer shall supply a letter of certification stating compliance to all the above standards prior to shipping any material to project site. The HDPE material shall have required ultraviolet inhibitors to resist degradation by direct and prolong sunlight. The design of HDPE materials shall be based on the hydrostatic design basis (HDB) of 1,600 psi at 73.4 degrees Fahrenheit. Pipe shall be designed and produced to ductile iron diameters and to a maximum dimension ratio of 11.

2. Fittings:

Fittings shall be HDPE molded and shall be made, at a minimum, to the same pressure rating as the pipe. All fabricated HDPE fittings shall be manufactured to a minimum thickness of DR 13.5. Ductile iron pipe fittings, with mechanical joint adapters, may be used when required for special connections but must be supplied by a pre-approved manufacturer. Manufacturers of the

electrofusion coupling and fittings shall be an ISO 9001 certified company with product having Canada Standards Association (CSA) certification.

2.02 AIR VALVES

A. General:

Wastewater force mains shall be equipped with combination air release valves located as shown on the PLANS. Valves shall be located in an enclosure as detailed on the STANDARD DRAWINGS.

B. Wastewater Combination Air Release Valve:

The valve body shall be conical in shape and shall be 316 stainless steel with a funnel shape lower body to automatically drain sewage back into the system. All internal parts shall be corrosion resistant 316 stainless steel or non-metallic plastic materials.

C. On flanged connections 316 stainless steel bolts, nuts and washers are to be used along with the proper sized gasket.

2.03 PLUG VALVES

A. General:

Wastewater force mains shall have plug valves as shown on the PLANS. Valves shall be installed as detailed on the STANDARD DRAWINGS.

1. Plug valves shall be eccentric, ballcentric, or full port.
2. Plug valves shall be installed complete with operating hand wheels, extension stems, buried gear actuators, 2-inch operating nuts as required for normal operation.
3. Valves shall have the name of the manufacturer and the size of the valve cast or molded onto the valve body. A permanent plate shall be attached to the valve or operator indicating serial number, order number, accessories, operator model and manufacturer, etc.
4. Ballcentric / Eccentric plug valves shall be of the non-lubricated type with 80 percent port areas. The port area for valves 4 to 20 inches shall have a minimum 80 percent nominal pipe diameter. Valves 24 inches and larger shall have a minimum port area of 70 percent of nominal pipe diameter.
5. Minimum pressure rating of valves 4 to 12 inches shall be 175 psi; valves 14 to 72 inches shall be 150 psi. Valve bodies shall be cast iron ASTM A 126, Class B and fusion bonded epoxy coated. Valve ends shall be screwed, flanged or mechanical joint as indicated on the drawings. Plugs shall be cast iron or ductile iron with neoprene facing and shall be of the single piece design. The plug shall be of the same configuration for all valves and shall require no stiffening member opposite the plug for balance or support. Valve body seats shall have a welded in overlay of not less than 90 percent nickel. Packing shall be adjustable and safely replaceable.

Bushing shall be 316 stainless steel in both upper and lower journals and be protected from foreign matter with the use of a grit seal or similiar. The valve should be capable of drip tight shut off with flow in either direction at the full pressure of the valve. All exposed nuts, bolts, springs and washers on buried service valves shall be 304 stainless steel. All above grade valves shall have 316 stainless steel hardware.

6. Face to face dimensions shall be in conformance to ASME B16.10 and the following dimensions:

Table 3310-2. Pump Station Plug Valve Flange Face to Face Dimensions.

Valve Size (inches)	Face to Face (inches)
4	9.0
6	10.5
8	11.5
12	14.0
16	17.75
20	23.5
24	42.0

B. Valve Testing:

Plug valves shall be tested in accordance with AWWA C504. Each valve shall meet the performance, leakage, and hydrostatic tests described in AWWA C504. The leakage test shall be applied to the face of the plug tending to unseat the valve. The manufacturer shall furnish certified copies of reports covering proof of design testing as described in AWWA C504.

C. Actuators:

Manual valves shall have lever or gear actuators and tee wrenches, extension stems, floor stands, etc. as indicated on the PLANS. All valves 6-inch and larger shall be equipped with buried service rated gear actuators. All buried valves shall have a 2 inch square operating nut. All gearing shall be enclosed in a semi-steel housing and be suitable for running in a lubricant with seals provided on all shafts to prevent entry of dirt and water into the actuator. All actuator shafts shall be supported on permanently lubricated bronze bearings. Actuators shall clearly indicate valve position and an adjustable stop shall be provided to set closing torque. All exposed nuts, bolts and washers shall be 316 stainless steel. Valve packing adjustment shall be accessible without disassembly of the actuator.

2.04 VALVE BOXES

A. All valves shall have cast-iron two-piece valve boxes. Valve boxes shall be provided Orange with suitable heavy bonnets and shall extend to such elevation at or slightly above the finished grade surface as directed by UTILITIES. The barrel shall be screw type only, having 5-1/4-inch shaft. The upper section shall have a flange at the bottom having sufficient bearing area to

prevent settling and shall be complete with locking cast iron covers. Covers shall have "SEWER" cast into the top for all wastewater mains.

B. Valve box with operating nut extension is required for any size main that is six feet or greater below finished grade. The extension shall be high strength, corrosion resistant steel construction and permanently attached to the operating nut. . The operating nut extension insert shall be one complete assembled unit with a self-adjusting extension stem system that fits inside a standard valve box that will accommodate variable trench depths six-feet and greater as shown in the STANDARD DRAWINGS. All moving parts of the extension stem shall be enclosed in a housing to prevent contact with the soil. A valve box centering device designed to eliminate the shifting of the valve box against the operating nut of the valve shall be used. Valve box assembly shall be adjustable to accommodate variable trench depths six-foot and greater as shown in the STANDARD DRAWINGS.

C. The stem assembly shall be of a telescoping design that allows for variable adjustment length. The material shall be at minimum galvanized square steel tubing. The stem assembly shall have a built-in device that prevents the stem assembly from disengaging at its fully extended length. The extension stem must be capable of surviving a torque test to 1,000 ft-lb without failure.

D. Valve boxes shall have locking lids.

E. All valve boxes in non-paved areas shall be installed with a valve collar as shown in the STANDARD DRAWINGS.

F. Accessories include valves, collars, tracing wire, and valve markers.

2.05 PRESSURE GAUGES

A. Pressure gauges shall be installed on each pump station discharge pipe as indicated on the STANDARD DRAWINGS. Each pressure gauge shall be direct mounted, diaphragm (type) gauge, stainless steel case, stainless steel sensing element, liquid filled, with a 4-1/2-inch diameter dial and furnished with a clear glass crystal window, 1/4-inch shut-off (isolation) valve. Gauges shall be weatherproofed. The face dial shall be white finished aluminum with jet-black graduations and figures. The face dial shall indicate the units of pressure measured in psi, gauges shall be provided with pressure at normal operations at the mid range of the gauge as acceptable to the County..

PART 3 – EXECUTION

3.01 MATERIAL IDENTIFICATION AND TESTING

A. Pipe Identification:

Each length of pipe shall bear the name or trademark of the manufacturer, the location of the manufacturing plant and the class or strength classification of the pipe. The markings shall be

plainly visible on the pipe barrel. Pipe, which is not clearly marked, is subject to rejection. The CONTRACTOR shall remove all rejected pipe from the project site within five NORMAL WORKING DAYS.

B. Material Testing Requirements:

1. If requested by UTILITIES, a sample of pipe to be tested shall be selected at random by UTILITIES or the testing laboratory hired by UTILITIES.
2. When the samples tested conform to applicable standards, all pipe represented by such samples shall be considered acceptable based on the test parameters measured. Copies of test reports shall be available before the pipe is installed on the project.
3. In the event that any of the test samples fail to meet the applicable standards, all pipe represented by such tests shall be subjected to rejection. The CONTRACTOR may furnish two additional test samples from the same shipment or delivery, for each sample that failed and the pipe will be considered acceptable if all of these additional samples meet the requirements of the applicable standards. All such retesting shall be at the CONTRACTOR's expense.
4. Pipe that has been rejected by UTILITIES shall be removed from the site of the work by the CONTRACTOR and replaced with pipe that meets these specifications.

END OF SECTION

SECTION 03 30 00 – CAST-IN-PLACE CONCRETE

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section specifies cast-in place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes, for the following:
 - 1. Footings.
 - 2. Slabs-on-grade.

1.3 DEFINITIONS

- A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash and other pozzolans, ground granulated blast-furnace slag, and silica fume; subject to compliance with requirements.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Design Mixtures: For each concrete mixture. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.
 - 1. Indicate amounts of mixing water to be withheld for later addition at Project site.
- C. Steel Reinforcement Shop Drawings: Placing drawings that detail fabrication, bending, and placement. Include bar sizes, lengths, material, grade, bar schedules, bent bar diagrams, bar arrangement, splices and laps, and supports for concrete reinforcement.
- D. Qualification Data: For Installer and manufacturer.
- E. Floor surface flatness and levelness measurements to determine compliance with specified tolerances.

1.5 QUALITY ASSURANCE

- A. **Installer Qualifications:** A qualified installer who employs on Project personnel qualified as ACI-certified Flatwork Technician and Finisher and a supervisor who is an ACI-certified Concrete Flatwork Technician.
- B. **Manufacturer Qualifications:** A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.
 - 1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."
- C. **Testing Agency Qualifications:** An independent agency, qualified according to ASTM C 1077 and ASTM E 329 for testing indicated, as documented according to ASTM E 548.
 - 1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-01 or an equivalent certification program.
 - 2. Personnel performing laboratory tests shall be ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician - Grade I. Testing Agency laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician - Grade II.
- D. **Source Limitations:** Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from one source, and obtain admixtures through one source from a single manufacturer.
- E. **ACI Publications:** Comply with the following unless modified by requirements in the Contract Documents:
 - 1. ACI 301, "Specification for Structural Concrete," Sections 1 through 5.
 - 2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."
- F. **Concrete Testing Service:** Engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixtures.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. **Steel Reinforcement:** Deliver, store, and handle steel reinforcement to prevent bending and damage.
- B. **Waterstops:** Store waterstops under cover to protect from moisture, sunlight, dirt, oil, and other contaminants.

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. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified.
 - 2. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

2.2 FORM-FACING MATERIALS

- A. Smooth-Formed Finished Concrete: Form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.
 - 1. Plywood, metal, or other approved panel materials.
- B. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.
- C. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch, minimum.
- D. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.
 - 1. Formulate form-release agent with rust inhibitor for steel form-facing materials.
- E. Form Ties: Factory-fabricated, removable or snap-off metal or glass-fiber-reinforced plastic form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.

2.3 STEEL REINFORCEMENT

- A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60, deformed.
- B. Plain-Steel Welded Wire Reinforcement: ASTM A 185, plain, fabricated from as-drawn steel wire into flat sheets.

2.4 REINFORCEMENT ACCESSORIES

- A. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows.

2.5 CONCRETE MATERIALS

- A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source, throughout Project:
 - 1. Portland cement: ASTM C 150, Type I. Supplement with the following at the contractor's option:
 - a. Fly Ash: ASTM C 618, Class F.
 - b. Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 100 or 120.
- B. Normal-Weight Aggregates: ASTM C 33, Class 1N coarse aggregate or better graded. Provide aggregates from a single source.
 - 1. Maximum Coarse-Aggregate Size: 1 inch nominal.
 - 2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.
- C. Water: ASTM C 94/C 94M.

2.6 ADMIXTURES

- A. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.
 - 1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
 - 2. Retarding Admixture: ASTM C 494/C 494M, Type B.
 - 3. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.

2.7 WATERSTOPS

- A. Flexible PVC Waterstops: CE CRD-C 572, for embedding in concrete to prevent passage of fluids through joints. Factory fabricate corners, intersections, and directional changes.
 - 1. Manufacturers:
 - a. Bometals, Inc.
 - b. Greenstreak.
 - c. Meadows, W. R., Inc.
 - d. Murphy, Paul Plastics Co.
 - e. Progress Unlimited, Inc.
 - f. Tamms Industries, Inc.
 - g. Vinylex Corp.
 - 2. Profile: Flat, dumbbell without center bulb.
 - 3. Dimensions: 6 inches by 3/8 inch thick; non-tapered.

2.8 VAPOR RETARDERS

- A. Plastic Vapor Retarder: ASTM E 1745, Class A. Include manufacturer's recommended adhesive or pressure-sensitive tape.
1. Products:
 - a. Fortifiber Corporation; Moistop Ultra A.
 - b. Raven Industries Inc.; Vapor Block 10.
 - c. Reef Industries, Inc.; Griffolyn Type-65G.

2.9 CURING MATERIALS

- A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.
1. Products:
 - a. ChemMasters; Spray-Film.
 - b. Dayton Superior Corporation; Sure Film.
 - c. Euclid Chemical Company (The); Eucobar.
 - d. L&M Construction Chemicals, Inc.; E-Con.
 - e. Meadows, W. R., Inc.; Sealtight Evapre.
 - f. Sika Corporation, Inc.; SikaFilm.
 - g. Symons Corporation, a Dayton Superior Company; Finishing Aid.
- B. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, dissipating.
1. Products:
 - a. ChemMasters; Safe-Cure Clear.
 - b. Conspec Marketing & Manufacturing Co., Inc., a Dayton Superior Company; W.B. Resin Cure.
 - c. Dayton Superior Corporation; Day Chem Rez Cure (J-11-W).
 - d. Euclid Chemical Company (The); Kurez DR VOX.
 - e. L&M Construction Chemicals, Inc.; L&M Cure R.
 - f. Meadows, W. R., Inc.; 1100 Clear.
 - g. Symons Corporation, a Dayton Superior Company; Resi-Chem Clear Cure.
- C. Clear, Waterborne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A.
1. Products:
 - a. Euclid Chemical Company (The); Super Diamond Clear VOX.
 - b. L&M Construction Chemicals, Inc.; Lumiseal WB Plus.
 - c. Meadows, W. R., Inc.; Vocomp-30.
 - d. Symons Corporation, a Dayton Superior Company; Cure & Seal 31 Percent E.

2.10 RELATED MATERIALS

- A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber or ASTM D 1752, cork or self-expanding cork.

- B. Semirigid Joint Filler: Two-component, semirigid, 100 percent solids, epoxy resin with a Type A shore durometer hardness of 80 per ASTM D 2240.
- C. Bonding Agent: ASTM C 1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene.
- D. Epoxy Bonding Adhesive: ASTM C 881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade to suit requirements, and as follows:
 - 1. Types I and II, non-load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

2.11 CONCRETE MIXTURES, GENERAL

- A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301.
 - 1. Use a qualified independent testing agency for preparing and reporting proposed mixture designs based on laboratory trial mixtures.
- B. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than Portland cement in concrete as follows:
 - 1. Fly Ash: 25 percent.
 - 2. Ground Granulated Blast-Furnace Slag: 50 percent.
 - 3. Combined Fly Ash or Pozzolan and Ground Granulated Blast-Furnace Slag: 50 percent Portland cement minimum, with fly ash or pozzolan not exceeding 25 percent.
- C. Limit water-soluble, chloride-ion content in hardened concrete to 0.5 percent by weight of cement.
- D. Admixtures: Use admixtures according to manufacturer's written instructions.
 - 1. Use water-reducing admixture in concrete, as required, for placement and workability.
 - 2. Use water-reducing admixture in pumped concrete and concrete with a water-cementitious materials ratio below 0.50.

2.12 CONCRETE MIXTURES FOR BUILDING ELEMENTS

- A. Footings: Proportion normal-weight concrete mixture as follows:
 - 1. Minimum Compressive Strength: 4000 psi at 28 days.
 - 2. Maximum Water-Cementitious Materials Ratio: 0.50.
- B. Slabs-on-Grade: Proportion normal-weight concrete mixture as follows:
 - 1. Minimum Compressive Strength: 4000 psi at 28 days.

2. Maximum Water-Cementitious Materials Ratio: 0.45.

2.13 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M, and furnish batch ticket information.
 1. When air temperature is between 85 and 90 degrees Fahrenheit, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 degrees Fahrenheit, reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.1 FORMWORK

- A. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.
- B. Limit concrete surface irregularities, designated by ACI 347R as abrupt or gradual, as follows:
 1. Class A, 1/8 inch for smooth-formed finished surfaces.
- C. Construct forms tight enough to prevent loss of concrete mortar.
- D. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast concrete surfaces.
- E. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.
- F. Chamfer exterior corners and edges of permanently exposed concrete.
- G. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.
- H. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.
- I. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.2 EMBEDDED ITEMS

- A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 1. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC's "Code of Standard Practice for Steel Buildings and Bridges."

3.3 VAPOR RETARDERS

- A. Plastic Vapor Retarders: Place, protect, and repair vapor retarders according to ASTM E 1643 and manufacturer's written instructions.
 - 1. Lap joints 6 inches and seal with manufacturer's recommended tape.

3.4 STEEL REINFORCEMENT

- A. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.
 - 1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.
- B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that would reduce bond to concrete.
- C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.
- D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.
- E. Install welded wire reinforcement in longest practicable lengths on bar supports spaced to minimize sagging. Lap edges and ends of adjoining sheets at least one mesh spacing. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire.

3.5 JOINTS

- A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.
- B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.
 - 1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints, unless otherwise indicated. Do not continue reinforcement through sides of strip placements of floors and slabs.
 - 2. Form keyed joints as indicated. Embed keys at least 1-1/2 inches into concrete.

3. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
- C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness as follows:
1. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.
- D. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such foundation walls, and other locations, as indicated.
1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface, unless otherwise indicated.
 2. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.

3.6 WATERSTOPS

- A. Flexible Waterstops: Install in construction joints and at other joints indicated to form a continuous diaphragm. Install in longest lengths practicable. Support and protect exposed waterstops during progress of the Work. Field fabricate joints in waterstops according to manufacturer's written instructions.

3.7 CONCRETE PLACEMENT

- A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.
- B. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Architect.
- C. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301.
1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.
- D. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.
1. Deposit concrete in horizontal layers of depth to not exceed formwork design pressures and in a manner to avoid inclined construction joints.

2. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.
 3. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.
- E. Deposit and consolidate concrete for slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.
1. Consolidate concrete during placement operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
 2. Maintain reinforcement in position on chairs during concrete placement.
 3. Screed slab surfaces with a straightedge and strike off to correct elevations.
 4. Slope surfaces uniformly to drains where required.
 5. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.
- F. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
1. When average high and low temperature is expected to fall below 40 degrees Fahrenheit for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
 2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
 3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.
- G. Hot-Weather Placement: Comply with ACI 301 and as follows:
1. Maintain concrete temperature below 90 degrees Fahrenheit at time of placement. Chilled mixing water 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.
 2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

3.8 FINISHING FORMED SURFACES

- A. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defects. Remove fins and other projections that exceed specified limits on formed-surface irregularities.

1. Apply to concrete surfaces to be covered with a coating or covering material applied directly to concrete.
- B. Related Unformed Surfaces: Horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces, unless otherwise indicated.

3.9 FINISHING SLABS

- A. General: Comply with ACI 302.1R recommendations for screeding, restraighening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.
- B. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power driven floats. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraighening until surface is left with a uniform, smooth, granular texture.
 1. Apply float finish to surfaces to receive trowel finish.
- C. Trowel Finish: After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.
 1. Apply a trowel finish to surfaces exposed to view or to be covered with resilient flooring, carpet, ceramic, or quarry tile set over a cleavage membrane, paint, or another thin-film-finish coating system.
 2. Finish surfaces to the following tolerances, according to ASTM E 1155, for a randomly trafficked floor surface:
 - a. Specified overall values of flatness, F(F) 35; and of levelness, F(L) 25; with minimum local values of flatness, F(F) 24; and of levelness, F(L) 17; for slabs-on-grade.

3.10 MISCELLANEOUS CONCRETE ITEMS

- A. Filling In: Fill in holes and openings left in concrete structures, unless otherwise indicated, after work of other trades is in place. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete the work.

3.11 CONCRETE PROTECTING AND CURING

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

- B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.
- C. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including slabs, concrete floor toppings, and other surfaces.
- D. Cure concrete according to ACI 308.1, by one or a combination of the following methods:
 - 1. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.
 - a. After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer unless manufacturer certifies curing compound will not interfere with bonding of floor covering used on Project.
 - 2. Curing and Sealing Compound: Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.

3.12 JOINT FILLING

- A. Prepare, clean, and install joint filler according to manufacturer's written instructions.
 - 1. Defer joint filling until concrete has aged at least one month. Do not fill joints until construction traffic has permanently ceased.
- B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joint clean and dry.

3.13 CONCRETE SURFACE REPAIRS

- A. Defective Concrete: Repair and patch defective areas when approved by Architect. Remove and replace concrete that cannot be repaired and patched to Architect's approval.
- B. Patching Mortar: Mix dry-pack patching mortar, consisting of one part portland cement to two and one-half parts fine aggregate passing a No. 16 sieve, using only enough water for handling and placing.
- C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.

1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch in any dimension in solid concrete, but not less than 1 inch in depth. Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.
 2. Repair defects on surfaces exposed to view by blending white Portland cement and standard Portland cement so that, when dry, patching mortar will match surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.
 3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by Architect.
- D. Repairing Unformed Surfaces: Test unformed surfaces, such as slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.
1. Repair finished surfaces containing defects. Surface defects include spalls, pop-outs, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
 2. After concrete has cured at least 14 days, correct high areas by grinding.
 3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.
 4. Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.
 5. Correct other low areas scheduled to remain exposed with a repair topping. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch to match adjacent floor elevations. Prepare, mix, and apply repair topping and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
 6. Repair defective areas, except random cracks and single holes 1 inch or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least a 3/4-inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mixture as original concrete except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.
 7. Repair random cracks and single holes 1 inch or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.

- E. Perform structural repairs of concrete, subject to Architect's approval, using epoxy adhesive and patching mortar.
- F. Repair materials and installation not specified above may be used, subject to Architect's approval.

3.14 FIELD QUALITY CONTROL

- A. Testing and Inspecting: Owner will engage a special inspector and qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. Inspections:
 - 1. Steel reinforcement placement.
 - 2. Verification of use of required design mixture.
 - 3. Concrete placement, including conveying and depositing.
 - 4. Curing procedures and maintenance of curing temperature.
- C. Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:
 - 1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd., but less than 25 cu. yd., plus one set for each additional 50 cu. yd. or fraction thereof.
 - a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
 - 2. Slump: ASTM C 143/C 143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
 - 3. Concrete Temperature: ASTM C 1064/C 1064M; one test hourly when air temperature is 40 degrees Fahrenheit and below and 80 degrees Fahrenheit and above, and one test for each composite sample.
 - 4. Compression Test Specimens: ASTM C 31/C 31M.
 - a. Cast and laboratory cure two sets of two standard cylinder specimens for each composite sample.
 - b. Cast and field cure two sets of two standard cylinder specimens for each composite sample.
 - 5. Compressive-Strength Tests: ASTM C 39/C 39M; test one set of two laboratory-cured specimens at 7 days and one set of two specimens at 28 days.
 - a. Test one set of two field-cured specimens at 7 days and one set of two specimens at 28 days.
 - b. A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.
 - 6. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.

7. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.
 8. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.
 9. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.
 10. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42/C 42M or by other methods as directed by Architect.
 11. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
 12. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.
- D. Measure floor and slab flatness and levelness according to ASTM E 1155 within 24 hours of finishing.

END OF SECTION 03300

SECTION 05 5000
METAL FABRICATIONS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes:
1. Rough hardware
 2. Miscellaneous framing and supports
 3. Steel Pipe bollards

1.2 PERFORMANCE REQUIREMENTS

- A. Thermal Movements: Provide exterior metal fabrications that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

1.3 SUBMITTALS

- A. Shop Drawings:
1. Show fabrication details for metal fabrications.
 2. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.
 3. Provide templates for anchors and bolts specified for installation under other Sections.
- B. Welder certificates signed by Contractor certifying that welders comply with requirements specified under the "Quality Assurance" Article.

1.4 QUALITY ASSURANCE

- A. Welding: Qualify procedures and personnel according to the following:
1. AWS D1.1, "Structural Welding Code--Steel."
 2. Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone re-certification.

1.5 PROJECT CONDITIONS

- A. Field Measurements: Check actual locations of in place construction to which fabrications must fit by field measurements before fabrication. Show measurements on final shop drawings.
1. Established Dimensions: Where field measurements cannot be made without delaying the Work, guarantee dimensions and proceed with fabricating products without field measurements. Coordinate construction to ensure that actual dimensions correspond to guaranteed dimensions. Allow for trimming and fitting.

1.6 COORDINATION

- A. Coordinate installation of anchorages for metal fabrications. 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.

PART 2 - PRODUCTS

2.1 METALS, GENERAL

- A. Metal Surfaces: 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. Rolled Structural Steel Shapes: ASTM A572, Grade 50.
- B. Steel Plates and Bars: ASTM A36.
- C. Steel Tubing:
 - 1. Cold-Formed Steel Tubing: ASTM A500
 - 2. Hot-Formed Steel Tubing: ASTM A501
- D. Steel Pipe: ASTM A53, standard weight (schedule 40), unless otherwise indicated, or another weight required by structural loads.
 - 1. Galvanized finish
- E. Welding Rods and Bare Electrodes: Select according to AWS specifications for the metal alloy to be welded.
- F. Galvanized Structural Steel Sheet: ASTM A446, of grade required for design loading. Coating designation as indicated, or if not indicated, G90.
- G. Brackets, Flanges, and Anchors: Cast or formed metal of the same type material and finish as supported rails, unless otherwise indicated.
- H. Galvanized sheet metal shall be commercial quality with 0.20 percent copper, ASTM A525; G90 hot-dip galvanized, mill phosphatized where indicated for painting; 24 gauge thickness except as otherwise indicated.

2.3 PAINT

- A. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79.
 - 1. Use primer with a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 2. Primer selected must be compatible with finish coats of paint. Coordinate selection of metal primer with finish paint requirements specified in Division 9.
- B. Galvanizing Repair Paint: High-zinc-dust-content paint for re-galvanizing welds in steel, and complying with SSPC-Paint 20.
- C. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187.

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, Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required.

2.5 GROUT

- A. Non-shrink, Nonmetallic Grout: Factory-packaged, non-staining, non-corrosive, nongaseous grout complying with ASTM C1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.

2.6 CONCRETE FILL FOR BOLLARDS

- A. Concrete Materials and Properties: Comply with requirements of Division 03 Section, Cast-in-Place Concrete, for normal-weight, air-entrained, ready-mix concrete with a minimum 28-day compressive strength of 3000 psi, unless higher strengths are indicated.

2.7 FABRICATION

- A. Form metal fabrications from materials of size, thickness, and shapes indicated but not less than that needed to comply with performance requirements indicated. Work to dimensions indicated or accepted on shop drawings, using proven details of fabrication and support. Use type of materials indicated or specified for various components of each metal fabrication.
- B. Form exposed work true to line and level with accurate angles and surfaces and straight sharp edges.
- C. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch, unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- D. Shear and punch metals cleanly and accurately. Remove burrs.
- E. Ease exposed edges to a radius of approximately 1/32 inch, unless otherwise indicated. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
- F. Remove sharp or rough areas on exposed traffic surfaces.
- G. 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 that no roughness shows after finishing, and contour of welded surface matches those adjacent.
- H. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners wherever possible. Use exposed fasteners of type indicated or, if not indicated, Phillips flat-head (countersunk) screws or bolts. Locate joints where least conspicuous.
- I. Provide for anchorage of type indicated; coordinate with supporting structure. Fabricate and space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.

- J. Pre-assemble items in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces.
- K. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.
- L. Fabricate joints that will be exposed to weather in a manner to exclude water, or provide weep holes where water may accumulate.

2.8 MISCELLANEOUS METAL FABRICATIONS

A. Rough Hardware

- 1. Furnish bent or otherwise custom-fabricated, bolts, plates, anchors, hangers, dowels, and other miscellaneous steel and iron shapes as required for framing and supporting woodwork, and for anchoring or securing woodwork to concrete or other structures.
- 2. Fabricate items to sizes, shapes, and dimensions required. Furnish malleable-iron washers for heads and nuts that bear on wood structural connections, and furnish steel washers elsewhere.

B. Miscellaneous Framing and Supports

- 1. Provide steel framing and supports for applications indicated that are not a part of structural steel framework as required to complete the Work.
- 2. Fabricate units to sizes, shapes, and profiles indicated and required to receive other adjacent construction retained by framing and supports. Fabricate from structural steel shapes, plates, and steel bars of welded construction using mitered joints for field connection. Cut, drill, and tap units to receive hardware, hangers, and similar items.
 - a. Fabricate units from slotted channel framing where indicated.
 - b. Furnish inserts if units are installed after concrete is placed.
- 3. Galvanize miscellaneous framing and supports in all locations.

C. Steel Channels for Overhead Door Openings

- 1. Fabricate steel door frame channels from structural shapes of size and to dimensions indicated, fully welded together.
- 2. Provide steel strap anchors for securing door frame channels into adjoining concrete or masonry, using 1/8 by 2 inch straps of the length required for a minimum 8 inch embedment, unless otherwise indicated. Weld anchors to frame jambs no more than 12 inches from both bottom and head of frame and space anchors not more than 30 inches apart.
- 3. Extend bottom of frames to floor elevation indicated with steel angle clips welded to frames for anchoring frame to floor with expansion shields and bolts.
- 4. Galvanize frames and anchors in all locations:

D. Pipe Bollards:

- 1. Steel: Fabricate from Schedule 80 steel pipe. Fill with concrete, dome top.
- 2. HDPE, Bollard Sleeve: Provide post guards sleeves fabricated from high density polyethylene (HDPE) that has been warranted against fading or color change for a period of five years from the date of substantial

completion and complying with the following:

- a. Nominal Thickness: 1/8-inch.
- b. Bollard Sleeve Size:
 - 1) Height: Provide bollard covers that fully encapsulate metal bollards. Refer to Drawings for metal bollard heights.
 - 2) Diameter: Provide bollard covers that fit bollard diameter sizes.
 - 3) Color by Architect.

2.9 STEEL AND IRON FINISHES

- A. Galvanizing: Hot-dip galvanize items as indicated to comply with applicable standard listed below:
 - 1. ASTM A123, for galvanizing steel and iron products
 - 2. ASTM A153, for galvanizing steel and iron hardware
- B. Shop Priming: Apply shop primer to uncoated surfaces of metal fabrications, except those with galvanized finishes and those to be embedded in concrete, sprayed-on fireproofing, or masonry, unless otherwise indicated. 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.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Examine areas and conditions under which fabrications are to be installed. Do not proceed until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing miscellaneous metal fabrications to in-place construction. Include threaded fasteners for concrete and masonry inserts, toggle bolts, through-bolts, lag bolts, wood screws, and other connectors as required.
- B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing miscellaneous metal fabrications. Set metal fabrication accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.
- C. Provide temporary bracing or anchors in formwork for items that are to be built into concrete masonry or similar construction.
- D. Set sleeves in concrete with tops flush with finish surface elevations. Protect sleeves from water and concrete entry.
- E. Fit exposed connections 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 the surfaces of exterior units that have been hot-dip galvanized after fabrication and are intended for bolted or screwed field connections.

- F. Field Welding:
 - 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 that no roughness shows after finishing, and contour of welded surface matches those adjacent.
- G. Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on reviewed Shop Drawings.

3.3 INSTALLING STEEL PIPE BOLLARDS

- A. Anchor bollards in concrete as indicated on the Drawings.
- B. Grout bollards solid, mound top surface.

3.4 ADJUSTING AND CLEANING

- A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with same material as used for shop painting to comply with SSPC-PA 1 requirements for touching up shop-painted surfaces.
 - 1. Apply by brush or spray to provide a 2.0-mil minimum dry film thickness.
- B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas, and apply galvanizing repair paint to comply with ASTM A780.

END OF SECTION 05 5000

SECTION 06 0500
COMMON WORK RESULTS FOR WOOD, PLASTICS, AND COMPOSITES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes work results requirements that are common to all other Division 06 Sections.

1.2 DEFINITIONS

- A. Exposed Surfaces
1. Surfaces visible when doors and drawers are closed
 2. Bottoms of cases more than 4 feet above floor
 3. Visible members in open cases or behind glass doors
- B. Semi-Exposed Surfaces
1. Members behind opaque doors, such as shelves, divisions, interior faces of ends, case back, drawer sides, backs and bottoms, and back face of doors
 2. Tops of cases 6'-6 or more above floor
- C. Concealed Surfaces: Surfaces not visible after installation.

1.3 SUBMITTALS

- A. Product Data:
1. Maintenance recommendations.
 2. Wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used.
 - a. Include written instructions for handling, storing, and finishing treated material.
 3. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Site.
 4. Fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements.
 5. Certification that chemical treatment complies with specification for each type of treatment.
 6. Acknowledgement of the detrimental effect of copper treated wood when in contact with untreated steel.

1.4 QUALITY ASSURANCE

- A. Fire-Test-Response Characteristics: Where indicated, provide materials with fire-test-response characteristics determined by a nationally recognized testing and inspecting agency according to ASTM D5664.
- B. Kiln dry all wood to the following maximum moisture content:
1. Exterior and non-conditioned spaces: 19 percent
 2. Interior, conditioned spaces: 15 percent

- C. Ensure all preservative is adequately fixed in wood. Reject lumber with surface residues of white salts. Provide wood that is kiln-dried after treatment or prefinished with a sealer.
- D. Obtain approvals from Building Official for alternative wood preservative treatment.
- E. No products used within the interior of the building shall contain No added formaldehyde including glues.
 - 1. Emission standards for particleboard, medium density fiberboard, hardwood plywood, and finished goods made with them must meet the EPA's publication "The Formaldehyde Emission Standards for Composite Wood Products Act of 2010"

1.5 PROJECT CONDITIONS

- A. Coordinate environmental requirements for casework installation areas. Do not deliver or install casework until temperature and relative humidity have been stabilized and will be maintained.
 - 1. Maintain temperature and humidity in installation area as required to maintain moisture content of installed casework within a 1.0 percent tolerance through date of Substantial Completion.
- B. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit work to be performed according to manufacturer's written instructions and warranty requirements and at least one coat of specified finish to be applied without exposure to rain.
- C. Verify dimensions by field measurement before fabrication where work adjoins other Work. Notify Architect of conditions that may cause delay to Project. Allow for trimming and fitting of cabinet work and trim.
- D. Coordination: Fit work to other Work; scribe and cope as required for accurate fit. Correlate location of furring, nailers, blocking, grounds, and similar supports and reinforcement to allow proper attachment of other work.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Protect materials against weather and contact with damp or wet surfaces. Provide for air circulation within and around stacks and under temporary coverings.
- B. Do not deliver interior wood products until environmental conditions meet requirements specified for installation areas.

PART 2 - PRODUCTS

2.1 PRESSURE TREATMENT OF WOOD

- A. Water Repellent Preservative: NWWDA-tested and -accepted formulation containing 3-iodo-2-propenyl butyl carbonate (IPBC) as its active ingredient.
- B. Preservative Treatment. Comply with performance requirements in AWPA U1.
 - 1. ACQ - Ammoniacal copper quarternary compound: Pressure-injected
 - 2. Use 0.25 lb/cu ft retention

3. Kiln dry after treatment to 19 percent maximum moisture content for lumber and 18 percent for plywood
 4. Optional Preservative Treatments:
 - a. CDDC: Copper hydroxide sodium dimethyldithiocarbamate
 - b. Acetylation process
- C. Acceptable Products:
1. NatureWood by Osmose, Inc.
 2. Preserve Plus by Chemical Specialties, Inc.
 3. Accoya Wood by Accsys Technologies

2.2 FIRE-RETARDANT-TREATMENT

- A. Fire-Retardant Particleboard: Panels made from softwood particles and fire-retardant chemicals mixed together at time of panel manufacture with flame-spread index of 25 or less and smoke-developed index of 25 or less per ASTM E 84.

2.3 MISCELLANEOUS MATERIALS

- A. Adhesives: Aliphatic-resin, polyurethane, or resorcinol wood glue recommended by manufacturer for general carpentry use.
- B. Multipurpose Construction Adhesive: Formulation complying with ASTM D 3498 that is recommended for indicated use by adhesive manufacturer.

2.4 FABRICATION

- A. Wood Moisture Content: Comply with requirements of specified inspection agencies and manufacturer's recommendations for moisture content of finish carpentry in relation to relative humidity conditions existing during time of fabrication and in installation areas. Provide finish carpentry with moisture content that is compatible with Project requirements.

PART 3 - EXECUTION

3.1 EXAMINATION

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

3.2 APPLICATION

- A. Brush apply preservative treatment material to cut ends of treated lumber. Use same material as used for original treatment.
- B. Installation of Pressure Treated Wood: No direct contact with untreated steel shall be allowed. Provide coating or sheet barriers to separate treated wood from steel. Apply only stainless steel fasteners into or through copper preservative treated wood.

3.3 ADJUSTMENTS, CLEANING, AND PROTECTION

- A. Protect installed woodwork from damage by other trades until the Date of Substantial Completion.

END OF SECTION 06 0500

SECTION 06 1000
ROUGH CARPENTRY

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes:
 - 1. Wood grounds, nailers, blocking, and sleepers
 - 2. Plywood backer panels
 - 3. Plywood sheathing

1.2 REFERENCES

- A. Lumber Standard: Comply with PS-20 and with applicable rules of the respective grading and inspecting agencies for species and products indicated.
- B. Plywood Product Standards: Comply with PS 1 (ANSI A199.1) or, for products not manufactured under PS 1 provisions, with applicable APA Performance Standard PRP-108 for type of panel indicated.

1.3 DEFINITIONS

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

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Keep materials under cover and dry. Protect against exposure to weather and contact with damp or wet surfaces. Stack lumber as well as plywood and other panels; provide for air circulation within and around stacks and under temporary coverings including polyethylene and similar materials.
 - 1. For pressure treated lumber and plywood, place spacers between each bundle to provide air circulation.

PART 2 - PRODUCTS

2.1 LUMBER, GENERAL

- A. Lumber Standards: Furnish lumber manufactured to comply with PS 20 "American Softwood Lumber Standard" and with applicable grading rules of inspection agencies certified by American Lumber Standards Committee's (ALSC) Board of Review.
- B. Inspection Agencies: SPIB - Southern Pine Inspection Bureau.
- C. Grade Stamps: Provide lumber with each piece factory-marked with grade stamp of inspection agency evidencing compliance with grading rule requirements and identifying grading agency, grade, species, moisture content at time of surfacing, and mill.
- D. Nominal sizes are indicated, except as shown by detail dimensions. Provide actual sizes as required by PS 20, for moisture content specified for each use.
 - 1. Provide dressed lumber, S4S, unless otherwise indicated.

2. Provide seasoned lumber with 19 percent maximum moisture content at time of dressing and shipment for sizes 2 inches or less in nominal thickness, unless otherwise indicated.
3. "Standard" grade.
4. Southern Pine graded under SPIB rules.

2.2 WOOD GROUNDS, NAILERS, BLOCKING, AND SLEEPERS

- A. Provide lumber for support or attachment of other construction including rooftop equipment curbs and support bases, cant strips, bucks, nailers, blocking, furring, grounds, stripping, and similar members.
- B. Fabricate miscellaneous lumber from dimension lumber of sizes indicated and into shapes shown.
- C. Grade: "Standard" grade light-framing-size lumber of any species or board-size lumber as required. No. 2 Boards per SPIB rules.
- D. Wood grounds, nailers, and sleepers shall be pressure treated as specified.

2.3 PLYWOOD PANELS

- A. Construction Panel Standards: Comply with PS 1 "U.S. Product Standard for Construction and Industrial Plywood" for plywood construction panels and, for products not manufactured under PS 1 provisions, with APA PRP-108.
- B. Trademark: Furnish construction panels that are each factory-marked with APA trademark evidencing compliance with grade requirements.
- C. Wall Sheathing: APA-rated Structural I sheathing
 1. Exposure Durability Classification: Exterior
 2. Span Rating: As required to suit stud spacing indicated
 3. Fire treated where scheduled
- D. Electrical or Telephone Equipment Backing Panels: DOC PS-1, Exposure 1 CD Plugged, fire retardant treated, Thickness: Minimum 15/32 inch. Paint per Division 09.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Discard units of material with defects that impair quality of rough carpentry construction and that are too small to use in fabricating rough carpentry with minimum joints or optimum joint arrangement.
- B. Set rough carpentry to required levels and lines, with members plumb and true to line and cut and fitted.
- C. Fit rough carpentry to other construction; scribe and cope as required for accurate fit. Coordinate location of furring, nailers, blocking, grounds, and similar supports to allow attachment of other construction.
- D. Attach rough carpentry work to substrate by anchoring and fastening indicated.
- E. Use IPBC treated products at interior locations and ACO or CDDC treated products at exterior locations.

- F. Apply field treatment complying with AWPA M4 to cut surfaces of preservative-treated lumber and plywood.
- G. All pressure treated wood installed in contact with steel decking, studs, or other framing members shall be separated by a minimum 40mil peel and stick membrane.

3.2 WOOD GROUNDS, NAILERS, BLOCKING, AND SLEEPERS

- A. Install wood grounds, nailers, blocking, and sleepers where shown and where required for screeding or attachment of other work. Form to shapes as shown and cut as required for true line and level of work to be attached.
- B. Attach to substrates as required to support applied loading. Countersink bolts and nuts flush with surfaces, unless otherwise indicated. Build into masonry during installation of masonry work. Where possible, anchor to formwork before concrete placement.
- C. Install permanent grounds of dressed, preservative treated, key-beveled lumber not less than 1-1/2 inches wide and of thickness required to bring face of ground to exact thickness of finish material involved. Remove temporary grounds when no longer required.
- D. Provide pressure treated blocking at all locations in contact with concrete. Fire treated where required.

3.3 INSTALLATION OF EQUIPMENT BACKER BOARDS

- A. Install 3/4 inch panels mounted to pressure treated 2 by 4, providing a 3 1/2 inch space behind panel for wiring.

END OF SECTION 06 1000

SECTION 07 2100
THERMAL INSULATION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes: Glass fiber batt insulation

1.2 SUBMITTALS

- A. Research or evaluation reports evidence compliance of foam-plastic insulations with FBC.
- B. Letter from pipe insulation manufacturer(s) and HVAC Duct insulation manufacturer(s) insulations provided contain no added urea formaldehyde.

1.3 QUALITY ASSURANCE

- A. Fire-Test-Response Characteristics: Provide materials specified as determined by testing identical products per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify materials with appropriate markings of applicable testing and inspecting agency.
1. Surface-Burning Characteristics: ASTM E84
 2. Combustion Characteristics: ASTM E136
- B. Toxicity/Hazardous Materials
1. Formaldehyde: Provide products that contain no added urea formaldehyde

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Protect insulation materials from physical damage and from deterioration by moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturers written instructions for handling, storing, and protection during installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers:
1. Glass-Fiber Batt Insulation:
 - a. CertainTeed Corporation Sustainable Insulation™
 - b. Johns Manville FKS Faced and unfaced
 - c. Knauf Insulation Knauf ECOBatt
 - d. Owens Corning Fiberglas Corp.: EcoTouch

2.2 INSULATING MATERIALS

- A. General: Provide insulating materials that comply with requirements and with referenced standards.
1. Prefomed Units: Sizes to fit intended application from manufacturer's standard widths.

- B. Unfaced Fiberglass Blanket Insulation: Comply with ASTM C665, Type I. Flame spread: 25 or less, smoke developed 50 or less in accordance with ASTM E84; Passing ASTM E136.

2.3 AUXILIARY INSULATING MATERIALS

- A. Wire: 0.177-inch-diameter metallic-coated steel marcelled tension wire conforming to ASTM A 824.
 - 1. Coating Type II zinc in the following class as determined by ASTM A 90, Class 2, with a minimum coating weight of 1.20 oz. per sq. ft. of uncoated wire surface.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine product upon delivery. Reject insulation delivered without identification or having lower efficiency than specified.
- B. Examine substrates and conditions, under which Work is to be performed. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean substrates of substances harmful to insulations or vapor retarders, including removing projections capable of puncturing vapor retarders or that interfere with insulation attachment.

3.3 INSTALLATION, GENERAL

- A. Comply with insulation manufacturer's written instructions applicable to products and application indicated.
- B. Install insulation that is undamaged, dry, unsoiled, and has not been exposed at any time to ice and snow.
- C. Extend insulation in thickness indicated 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. Water-Piping Coordination: If water piping is located within insulated exterior walls, coordinate location of piping to ensure that it is placed on warm side of insulation and insulation encapsulates piping.

3.4 INSTALLATION OF BUILDING INSULATION

- A. Install blanket insulations between structural members, held in place with tie wire.:

3.5 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 07 2100

SECTION 07 9000
JOINT PROTECTION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes interior and exterior sealants.
 - 1. All exterior joints and interior joints where thermal or dynamic movement is anticipated shall be subcontracted to a single firm specializing in sealant installation.

1.2 SYSTEM PERFORMANCE REQUIREMENTS

- A. Provide joint sealants that establish and maintain watertight and airtight continuous joint seals without staining or deteriorating joint substrates.

1.3 SUBMITTALS

- A. Sample warranties

1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain joint sealant materials from a single manufacturer for each different product required and who will, if required, send a qualified technical representative to project site for the purpose of advising the Installer of procedures and precautions for the use of the materials.
- B. Installer Qualifications: Engage an experienced installer who has completed joint sealant applications similar in material, design, and extent to that indicated for Project that have resulted in construction with a record of successful in-service performance.
 - 1. Installer shall be a sealant and caulking subcontractor, authorized or licensed by the sealant manufacturer, with a minimum of 5 years of successful experience in the application of the types of materials required.
- C. Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 to conduct the testing indicated, as documented according to ASTM E 548.
- D. Product Testing:
 - 1. Provide joint sealant based on tests conducted by a qualified independent testing laboratory on current product formulations within a 24 month period preceding date of Contractor's submittal of test results to Architect.
 - a. Test elastomeric sealants for compliance with requirements specified by reference to ASTM C 920. Include test results for hardness, stain resistance, adhesion and cohesion under cyclic movement (per ASTM C 719), modulus of elasticity at 100 percent strain, effects of heat aging, and effects of accelerated weathering.
 - b. Include test results performed on joint sealants after they have cured for 1 year.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in original unopened containers or bundles with labels indicating manufacturer, product name and designation, color, expiration, pot life, curing time, and mixing instructions for multi-component materials.
- B. Store and handle materials in compliance with manufacturer's recommendations.

1.6 PROJECT CONDITIONS

- A. Do not proceed with installation of joint sealants under the following conditions:
 - 1. When ambient and substrate temperature (or below 40 deg F) conditions are outside the limits permitted by joint sealant manufacturer.
 - 2. When joint substrates are wet.
 - 3. Where joint widths are less than allowed by joint sealant manufacturer for application indicated.
 - 4. Until contaminants capable of interfering with adhesion are removed from joint substrates.
- B. Preparation of joint surfaces, backing, and the conditions under which the sealant and caulking is to be installed shall conform to manufacturer's recommendations.
 - 1. Use of bond break tape is prohibited without the expressed permission of the Architect. Each situation will be evaluated with regard to inability to properly use backer rod to prevent adhesion.

1.7 WARRANTY

- A. All exterior and building envelope weathertight and watertight sealants shall be warranted by the sealant manufacturer for a period of twenty years from the Date of Substantial Completion. Include coverage for installed sealants and accessories which fail to achieve a watertight seal, exhibit loss of adhesion or cohesion, or do not cure.
- B. All exterior and building envelope weathertight and watertight sealants shall be guaranteed by the installing contractor for a period of five (5) years from the Date of Substantial Completion, to be weathertight, watertight and moisture tight. Correct defective or failed joints within the warranty period.
- C. Special warranties specified in this Article exclude deterioration or failure of elastomeric joint sealants from the following:
 - 1. Movement of the structure resulting in stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression caused by structural settlement or errors attributable to design or construction.
 - 2. Disintegration of joint substrates from natural causes exceeding design specifications.
 - 3. Mechanical damage caused by individuals, tools, or other outside agents.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Compatibility: Provide joint sealants, joint fillers, and other related materials that are compatible under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
- B. Surface Hardness: Provide types of sealant to withstand anticipated abrasive or

possible indentation as recommended by manufacturer.

C. Colors: Black or clear.

2.2 MATERIALS

A. General

1. Where the term "Acceptable Standard" is used within this Section, it refers to the manufacturer and product listed, which is specified as the type and quality required for this Project.
2. Products of other manufacturers will be considered, providing their products equal or exceed the quality specified, and they can provide products of the type and quality required.

B. Caulking Compounds (Acrylic Latex Sealant)

1. Latex rubber modified, acrylic emulsion polymer sealant compound; manufacturer's standard, one part, non-sag, mildew resistant, acrylic emulsion sealant complying with ASTM C834, recommended for exposed applications on interior locations involving joint movement of not more than plus or minus 5 percent.
2. Acceptable Standard
 - a. Sonolac; BASF
 - b. Acrylic Latex Caulk; Tremco, Inc.
 - c. Acrylic Latex Caulk with Silicone; DAP, Dayton, Ohio

C. One-Part Elastomeric Sealant

1. Comply with ASTM C920, Class 50, Type NS (non-sag), unless Type S (self-leveling) recommended by manufacturer for the application shown.
2. Acceptable Standard
 - a. Dow Corning 790; Dow Corning Corp. (Dow Corning 791 with Kynar coatings)
 - b. Pecora 864 Architectural Silicone Sealant; Pecora Corp.
 - c. Silpruf; General Electric
 - d. Sonolastic BASF
 - e. Spectrem 1; Tremco Mfg. Co.

D. Miscellaneous Materials

1. Primer: Type recommended by joint sealer manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint sealer substrate tests and field tests.
2. Cleaners for Nonporous Surfaces: Non-staining, chemical cleaners of type which are acceptable to manufacturers of sealants and sealant backing materials, which are not harmful to substrates and adjacent nonporous materials, and which do not leave oily residues or otherwise have a detrimental effect on sealant adhesion or in service performance.
3. Masking Tape: Non-staining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

2.3 JOINT SEALANT BACKING

A. Provide sealant backings of material and type that are non-staining, compatible with substrates, sealants, primers and other joint fillers, and are approved for

applications indicated by sealant manufacturer based on field experience and laboratory testing.

- B. Plastic Foam Joint Fillers: ASTM C 1330, of type indicated below and of size and density to control sealant depth and otherwise contribute to produce optimum sealant performance:
 - 1. Type C: Closed-cell material with a surface skin
- C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer. Provide self adhesive tape where applicable.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine joints to receive joint sealants for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint sealant performance. Do not proceed with installation of joint sealants until unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants complying with recommendations of sealant manufacturer and the following requirements:
 - 1. Remove all foreign material from joint substrates that could interfere with adhesion, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, and surface dirt.
 - 2. Clean concrete, masonry, unglazed surfaces of ceramic tile, and similar porous joint substrate surfaces by brushing, grinding, blast cleaning, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining from cleaning operations by vacuum or blowing out joints with oil-free compressed air.
 - 3. Remove laitance and form release agents from concrete.
 - 4. Clean metal, glass, porcelain enamel, glazed surfaces of ceramic tile, and other nonporous surfaces with cleaners that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants.
- B. Joint Priming: Prime joint substrates where indicated or where recommended by joint sealant manufacturer. Apply primer to comply with joint sealant manufacturer's recommendations. Confine primers to areas of joint sealant bond; do not allow spillage or migration onto adjoining surfaces.
- C. Masking Tape: Use masking tape where required to prevent contact of sealant with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 SELECTION OF MATERIAL

- A. Caulking compounds shall be used for interior nonmoving joints and at locations

specifically indicated on Drawings.

- B. One component elastomeric silicone sealants shall be used at all exterior joints and interior joints where thermal dynamic movement is anticipated.

3.4 INSTALLATION OF JOINT SEALANTS

- A. General: Comply with joint sealant manufacturer's printed installation instructions applicable to products and applications indicated, except where more stringent requirements apply.
 - 1. Interior joints which require caulking are to be caulked with the specified caulking compound, unless noted otherwise.
 - 2. Exterior joints which require sealant are to be filled with one of the specified sealants even though the note may read "Caulked".
 - 3. Joints to be filled shall be dry and free from dust, dirt, oil, and grease at the time of application or caulks or sealants.
 - 4. Expansion and control joints in exterior walls shall have the joint filler material built into the wall, or between wall and slab, at the time of construction.
 - 5. Masking: Metal shall be masked with masking tape, as well as other surfaces where it's required to prevent the sealant smearing the adjacent surface. Upon completion of the caulking, remove the tape.
- B. Sealant Installation Standard: Comply with recommendations of ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
- C. Installation of Sealant Backings: Install sealant backings to comply with the following requirements:
 - 1. Install joint fillers of type indicated to provide support of sealants during application and at position required to produce the cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
 - a. Do not leave gaps between ends of joint fillers.
 - b. Do not stretch, twist, puncture, or tear joint fillers.
 - c. Remove absorbent joint fillers that have become wet prior to sealant application and replace with dry material.
- D. Installation of Sealants: Install sealants by proven techniques that result in sealants directly contacting and fully wetting joint substrates, completely filling recesses provided for each joint configuration, and providing uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability. Install sealants at the same time sealant backings are installed.
- E. Tooling of Non-sag Sealants: Immediately after sealant application and prior to time skinning or curing begins, tool sealants to form smooth, uniform beads of configuration indicated, to eliminate air pockets, and to ensure contact and adhesion of sealant with sides of joint. Remove excess sealants from surfaces adjacent to joint. Do not use tooling agents that discolor sealants or adjacent surfaces or are not approved by sealant manufacturer.
 - 1. Provide concave joint configuration per Figure 5A in ASTM C 1193,

unless otherwise indicated.

3.5 CLEANING AND PROTECTION

- A. Clean off excess sealants or sealant smears adjacent to joints as work progresses by methods and with cleaning materials approved by manufacturers of joint sealants and of products in which joints occur.
- B. Protect joint sealants during and after curing period from contact with contaminating substances or from damage resulting from construction operations or other causes so that they are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so that and installations with repaired areas are indistinguishable from original work.

END OF SECTION 07 9000

SECTION 08 1100
METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes hollow metal doors and frames.

1.2 DEFINITIONS

- A. Standard Hollow Metal Work: Hollow metal work fabricated according to ANSI/SDI A250.8.

1.3 SUBMITTALS

- A. Shop Drawings:
1. Show elevations, details and methods of assembling sections, hardware locations and installation methods, dimensions, shapes of materials, anchorage and fastening methods, wall opening construction details, louver details, and weatherstripping.
 2. Provide schedule of doors and frames using same reference numbers for details and openings as those on Contract Documents.
 3. Wind loading Calculations shall be stamped, sealed and signed by a Professional Engineer in the State of Florida verifying compliance with ASCE 7-10.
 4. Sample of Approved Product Label and location of attachment to assembly.
- B. Sample warranty

1.4 QUALITY ASSURANCE

- A. Provide hollow metal work from a single manufacturer complying with Steel Door Institute "Recommended Specifications for Standard Steel Doors and Frames" ANSI/SDI A250.8 and as specified.
- B. Hollow metal supplier shall be a qualified direct distributor of products to be furnished. In addition, the distributor shall have in their regular employment an A.H.C./C.D.C. who will be available at reasonable times to consult with the Architect regarding matters affecting the doors and frames.
- C. Design exterior steel doors to meet wind-loading requirements for the FBC. Refer to Structural Drawings for wind and design pressures.
1. All exterior door assemblies shall be compliant with Florida Building Code rule 9N-3 for statewide product approval and require a Florida Product approval number.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver doors and frames cardboard-wrapped or crated to provide protection during transit and job storage. Provide additional protection to prevent damage to finish.

- B. Inspect units upon delivery for damage. Minor damages may be repaired provided refinished items are equal in all respects to new work and acceptable to Architect; otherwise, remove and replace damaged units as directed.
- C. Store doors and frames at building site under cover. Place units on minimum 4 inches high wood blocking. Avoid use of non-vented plastic or canvas shelters that could create humidity chamber. If cardboard wrapper on door becomes wet, remove carton immediately. Provide 1/4 inch spaces between stacked doors to promote air circulation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Provide products from one of the following manufacturers:
 - 1. Amweld Building Products
 - 2. Basis of Design (Exterior with louver): FL10723 Product Approval by Ceco Door Products with louver No. D0274.
 - 3. Steelcraft, an Ingersoll-Rand business
 - 4. Curries Company
 - 5. Mesker Door, Inc.
 - 6. Firedoor Corp.
 - 7. Architectural Openings, Inc.

2.2 MATERIALS

- A. Cold-Rolled Steel Sheets: ASTM A 1008, Commercial Steel (CS), Type B; suitable for exposed applications.
- B. Galvanized Steel Sheets: ASTM A 653, Commercial Steel (CS), Type B; with minimum A60 metallic coating.
- C. Supports and Anchors: Fabricate of not less than 18-gage Commercial Steel (CS) 40Z coating designation; mill phosphatized.
 - 1. For anchors built into exterior walls, steel sheet complying with ASTM A 1008 or ASTM A 1011, hot-dip galvanized according to ASTM A 153, Class B.
- D. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A 153.

2.3 FABRICATION, GENERAL

- A. Fabricate units rigid, free from defects, warp, or buckle. Form metal to required sizes and profiles. Wherever practicable, fit and assemble units in the manufacturer's plant. Identify work that cannot be permanently factory assembled before shipment, to assure proper assembly at the Site.
- B. Tolerances: Fabricate hollow metal work to tolerances indicated in SDI 117.
 - 1. Lock edge of doors: Bevel 1/8 inch in 2 inches.
- C. Fabricate panels and edge channels from galvanized sheet steel for exterior doors. For interior doors, fabricated from cold rolled sheet steel.
- D. Fabricate concealed stiffeners, reinforcement, edge channels, and moldings from either cold rolled or hot rolled steel (at fabricator's option).

- E. Unless otherwise indicated, provide countersunk flat Phillips heads for exposed screws.
- F. Hardware Preparation:
 - 1. Prepare hollow metal units to receive mortised and concealed door hardware, including cutouts, reinforcing, drilling, and tapping in accordance with final door hardware schedule and templates provided by hardware supplier. Comply with applicable requirements of ANSI/SDI A250.6 and ANSI/DHI A115 Series "Specifications for Door and Frame Preparation."
 - 2. Reinforce hollow metal units to receive surface applied hardware. Drilling and tapping for surface applied door hardware may be done on Site.
 - 3. Locate finish hardware as shown on final shop drawings, or if not shown, in accordance with recommended hardware locations specified in ANSI/SDI A250.8.
 - 4. Reinforce all steel doors and frames to receive surface mounted closers, whether or not scheduled to receive them.
 - 5. Coordinate locations of conduit and wiring boxes for electrical connections with Electrical Sections.
- G. Shop Painting
 - 1. Clean, treat, and shop paint all surfaces of fabricated hollow metal doors and frames, including galvanized surfaces.
 - 2. Clean steel surfaces of mill scale, rust, oil, grease, dirt, and other foreign materials before the application of the shop coat of paint.
 - 3. Apply shop coat of prime paint of even consistency to provide a uniformly finished surface ready to receive field applied paint.
 - a. 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.

2.4 DOOR TYPES

- A. Conform to the Steel Door Institute Standards, ANSI/SDI A250.8, and as follows:
- B. Exterior Doors: Grade III, 1-3/4 inches extra heavy duty, 16 gage galvanized, Model 2, seamless design. (Coordinate gage with tested assemblies required for wind loading at exterior locations.)
 - 1. Form door face sheets from one sheet of metal, with no visible seams on the door face or edges.
 - 2. Provide weep-hole openings in bottom of exterior doors to permit moisture to escape. Seal joints in top edges of doors against water penetration.
 - 3. Design: Flush panel
 - 4. Core: Rigid polystyrene slabs bonded to door face sheets.
- C. Interior Doors: Grade II, 1-3/4 inch heavy duty, 18 gage cold rolled, Model 1, full flush, hollow steel construction.

1. Form door face sheets from one sheet of metal with no face seams. Seams on vertical door edges shall be tight, smooth, and devoid of irregularities. A kraft resin impregnated honeycomb core or rigid polystyrene slab shall be permanently bonded to both door skins with adhesive recommended by the manufacturer.
- D. Seamless construction by welding and filling at factory only.
- E. Heat-Treated Float Glass: ASTM C 1048; Type I (transparent flat glass); Quality-Q3; of class, 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. Provide Kind FT (fully tempered) float glass in place of annealed or Kind HS (heat-strengthened) float glass where scheduled or required by Code.

2.5 DOOR ACCESSORIES

- A. Glass Stops and Moldings: Provided for vision light openings.
 1. Glaze doors from the secure side.
- B. Verify undercut requirements with Division 08 Section, Finish Hardware, for exterior doors with thresholds. Standard undercut will not be acceptable for low profile handicap thresholds.
- C. Provide plastic water stop insert at the top of all doors where steel closure is not provided at top.

2.6 FRAME TYPES

- A. Frames for Exterior Door Openings: 14 gage
 1. Frames for exterior use shall be hot-dipped galvanized steel after fabrication.
- B. Frames for Interior Door and Window Openings: 16 gage, fabricated from cold rolled sheet steel.
- C. Welded Frames: Weld flush face joints continuously, grind, fill, dress, and make smooth, flush and invisible.

2.7 FRAME ASSEMBLIES

- A. Frame Anchors
 1. Wall anchors for frame attachment to masonry construction: Adjustable, flat, corrugated or perforated 'T' shaped anchors with leg not less than 2 inches wide by 10 inches long or masonry "wire" type not less than 3/16 inch diameter.
 2. Stud-Wall Type: Designed to engage stud, welded to back of frames; not less than 0.042 inch thick.
 - a. Size anchors to accommodate frame jamb depth and face dimension on all welded frames
 3. Floor anchors:

- a. Angle clip type
 - b. 16 gage minimum
 - c. Two fasteners per jamb
 - d. Weld to the bottom of each jamb
4. Head Struts: For frames not anchored to masonry or concrete construction provide ceiling struts spot welded to jambs each side extending to building structure where called for on schedule.
- B. Stops and Beads: 20 gage, installed on the interior side of exterior frames.
- C. Mortar Boxes: 26 gage steel, welded to the frame, at back of hardware cutouts where mortar or other materials might obstruct hardware operation.
- D. Door Silencers: Drill stops and install 3 silencers on strike jambs of single swing frames and 2 silencers on heads of double swing frames.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install standard steel doors, frames, and accessories in accordance with final Shop Drawings and the Contract Documents.
- B. Placing Frames: Comply with ANSI A250.11.
1. Except for frames located at existing concrete, masonry or drywall installations, place frames prior to construction of walls.
 2. Set frames, plumbed, aligned, and braced until permanent anchors are set. After wall construction is completed, remove temporary braces and spreaders.
 - a. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.
 3. In masonry construction, locate 3 wall anchors per jamb adjacent to hinge location on hinge jamb and at corresponding heights on strike jamb. Coordinate installation to allow for grouting frames solid. Do not allow frames to deform by grout forces.
 4. In metal stud partitions, install at least 3 wall anchors per jamb at hinge and strike levels.
 5. Anchor bottom of frames to floors with expansion bolts or with power fasteners. Where frames require ceiling struts or other structural overhead bracing, anchor to ceilings or structural framing above, as indicated or specified.
 6. 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.
 7. Finished work shall be rigid, neat in appearance, and free from defects. Form molded members straight and true with joints coped or mitered, well formed, and in true alignment. Welded joints on exposed surfaces shall be dressed smooth so they are invisible after finishing.
 8. Refer to Division 04 Section, Concrete Masonry Units for metal frame grout. Do not spot grout metal frames in gypsum wallboard partitions.

9. Recess bolt heads, bondo and sand smooth where anchor bolts are used in concrete or masonry openings
 10. Provide filler plate at all hardware preps, such as hinge and strike preps, that are unused.
- C. Door Installation: Fit hollow metal doors accurately in frames, within clearances specified in ANSI/SDI A250.8.
1. Jambs and Head: 1/8 inch plus or minus 1/16 inch.
 2. Between Edges of Pairs of Doors: 1/8 inch plus or minus 1/16 inch.
- 3.2 ADJUST AND CLEAN
- A. Prime Coat Touch-up: Immediately after erection, sand smooth any rusted or damaged areas of prime coat and apply touch-up of compatible air-drying primer.
- B. Protection Removal: Immediately prior to final inspection, remove protective plastic wrappings from prefinished doors.
- C. Final Adjustments: Check and readjust operating hardware items, leaving steel doors and frames undamaged and in complete and proper operating condition.
- 3.3 FIELD QUALITY CONTROL
- A. Damaged work will be rejected. Replace with new work at no additional cost to the Contract.
- B. After installation, protect doors and frames from damage during subsequent construction activities.

END OF SECTION 08 1100

SECTION 08 3100
ACCESS DOORS AND PANELS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes access doors.
- B. Refer to MEP documents for additional requirements.

1.2 QUALITY ASSURANCE

- A. Coordinate locations and sizes of access doors with Electrical and Mechanical Drawings. Provide access doors as required for access to concealed valves, pipes, connections, motors, and other items that will need to be accessed for maintenance purposes.
- B. Fire Rated Openings: Provide only units which have been tested and listed by UL, FM, or WH and are acceptable to the authorities having jurisdiction and for the types required.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Provide access doors by one of the following:
 - 1. Cesco Products
 - 2. Milcor, Inc., A Gibraltar Co.
 - 3. Nystrom, Inc.

2.2 MATERIALS AND FABRICATION

- A. Provide each access door assembly manufactured as an integral unit, complete, ready for installation.
- B. Provide stainless steel doors and frames where located on Drawings for conditions noted.
 - 1. Stainless-Steel Sheet, Strip, Plate, and Flat Bars: ASTM A 666, Type 304. Remove tool and die marks and stretch lines or blend into finish.
 - 2. Finish: Directional Satin Finish, No. 4
- C. Gypsum Board Walls and Ceilings:
 - 1. Frames: 16 gage cold rolled steel, perforated with galvanized drywall bead attached to all four sides
 - 2. Recess: 5/8 inch
 - 3. Hinges: Cold rolled with stainless steel pin, continuous piano type
 - 4. Doors: 20 gage cold rolled steel
 - 5. Size: 24 inch by 24 inch, unless indicated otherwise
- D. Latching Devices: Furnish flush, screwdriver operated cam locks of number required to hold door in flush, smooth plane when closed.
- E. Provide one key-operated cam lock per access door. Furnish 2 keys per lock. Key locks alike, unless otherwise scheduled.
 - 1. Only one key operated latching device is required per panel.

- F. Factory primed with manufacturer's standard primer for condition indicated.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Provide UL Labeled, fire-rated access doors and panels when required to be installed in fire-rated walls or ceilings.
- B. Comply with manufacturer's instructions for installation of access doors and panels.
- C. Coordinate installation with work of other trades.
- D. Coordinate locking requirements with the Owner.
- E. Set frames accurately in position and securely attach to supports with face panels plumb or level in relation to adjacent finish surfaces.
- F. Finish: Field paint by Division 09 Section, Painting.

3.2 ADJUST AND CLEAN

- A. Adjust hardware and panels after installation for proper operation.
- B. Remove and replace panels or frames which are warped, bowed, or otherwise damaged.

END OF SECTION 08 3100

SECTION 08 3323
OVERHEAD COILING DOORS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes overhead coiling doors

1.2 PERFORMANCE REQUIREMENTS

- A. Design door to meet wind-loading requirements of the FBC. Refer to structural drawings for wind and design pressures.
1. All exterior door assemblies shall be compliant with Florida Building Code rule 9N-3 for statewide product approval and require a Florida Product approval for the Miami-Dade Area (Miami-Dade NOA).
- B. Endlocks/windlocks shall be installed on every slat on doors over 14 feet wide.
- C. Air Infiltration: Maximum rate of 0.08 cfm/sq. ft. at 15 and 25 mph when tested according to ASTM E283.
- D. Overhead coiling doors shall be designed to a standard maximum of 10 cycles per day and an overall maximum of 20,000 operating cycles for the life of the door.

1.3 SUBMITTALS

- A. Product Data: For each type and size of overhead coiling door and accessory.
1. Include operation and maintenance data for overhead coiling doors to include in maintenance manuals.
 - a. Include spare parts list, together with part numbers and cut sheets for repairs.
- B. Shop Drawings
1. Show elevations of each door type, shape and thickness of materials, finishes, details of guides and fittings, rough opening dimensions, location of hardware, anchorage and fastening methods, counterbalancing mechanism, and door operator details.
 - a. Include locations of replaceable fusible links on wiring diagrams for power, signal and controls.
 - b. Provide a statement from the manufacturer on the average approximate time to open the door fully in manual override mode.
 2. Rated capacities, operating characteristics, electrical characteristics, and furnished accessories
 3. Diagrams for power, signal, and control wiring
 4. Show locations of controls, locking devices, detectors, or replaceable fusible links, and other accessories.
 5. Provide schedule of doors using same reference numbers for details and openings as those on Contract Documents.

6. Wind loading Calculations shall be stamped, sealed and signed by a Professional Engineer in the State of Florida verifying compliance with ASCE 7-10 for exterior applications
 7. Miami-Dade NOA documentation.
- C. Samples: Manufacturer's finish charts showing full range of colors and textures available for units with factory-applied finishes.
 - D. Certificates: Manufacturer's certification that doors meet specified requirements.
 - E. Draft copy of Maintenance Agreement
 - F. Sample warranty
 - G. Spare Parts: Provide Owner with one set of critical parts to make emergency repairs.

1.4 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in performing Work of this section with a minimum of five years experience in the fabrication and installation of security closures.
- B. Installer Qualifications: An entity that employs installers and supervisors who are certified or otherwise approved by manufacturer for both installation and maintenance of units required for this Project.
- C. Single-Source Responsibility: Provide doors, tracks, motors, and accessories from one manufacturer for each type of door. Provide secondary components from source acceptable to manufacturer of primary components.
- D. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories, Inc. acceptable to authority having jurisdiction as suitable for purpose specified.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver doors wrapped in a protective covering with the brands and names clearly identified.
- B. Store products in manufacturer's unopened packaging in a dry, warm, ventilated weathertight location until ready for installation.
- C. Protect materials from exposure to moisture. Do not deliver until after wet work is complete and dry.

1.6 PROJECT CONDITIONS

- A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.7 WARRANTY

- A. Warranty: Manufacturer's limited door and operator system, except the counterbalance spring and finish, to be free from defects in materials and workmanship for 3 years.
- B. Warranty: Manufacturer's limited door warranty for 2 years for all parts and components, including helical spring and counterbalance mechanism

PART 2 - PRODUCTS

2.1 MANUFACTURER

- A. Basis of Design: Stormtite Model 620, face of wall mount, by Overhead Door Corporation
- B. Products of the following manufacturers are acceptable, providing their products equal or exceed the quality specified, and they can provide products of the type, size, function, and arrangement required.
 - 1. Kinneer Division of Wayne Dalton Corp.
 - 2. The Cookson Company
 - 3. Cornell Ironworks

2.2 MATERIALS AND CONSTRUCTION

- A. Door Curtain: Interconnected strip steel slats conforming to ASTM A653.
 - 1. Nominal 3 inch flat roll-formed of 18 gage or as required to meet wind loading.
 - 2. R-Value: 4 when calculated in accordance with ASHRAE FUN IP
 - 3. Steel to be hot dipped galvanized G-90 consistent with ASTM A653.
 - 4. Interior face of insulated to match exterior in materials and finish
- B. Finish: Manufacturer's standard baked finish or powder-coat finish. Color by Architect.
- C. Weatherseals for Exterior Doors: Equip each exterior door with weather-stripping gaskets fitted to entire exterior perimeter of door for a weather-resistant installation unless otherwise indicated.
 - 1. At door head, use 1/8 inch thick, replaceable, continuous-sheet baffle secured to inside of hood or field- installed on the header.
 - 2. At door jambs, use replaceable, adjustable, continuous seals of flexible vinyl, rubber, or neoprene.
- D. Guides: Provide galvanized steel guides with sufficient depth and strength to retain curtain, and to withstand loading. Ensure curtain operates smoothly. Slot bolt holes for track adjustment. Exposed finish to match slats.
 - 1. Provide removable guide stoppers to prevent over travel of curtain bottom bar
 - 2. Include all anchors, fasteners, and accessories required for installation to meet Performance Requirements
 - 3. Provide exterior door guides with continuous weatherstrip attached to the side guides
- E. Insulation: Fill slats for insulated doors with manufacturer's standard thermal insulation complying with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, according to ASTM E 84 or UL 723. Enclose insulation completely within slat faces.
- F. Counterbalance Assembly: Counterbalance doors by means of manufacturer's standard mechanism with an adjustable-tension, steel helical torsion spring mounted around a steel shaft and contained in a spring barrel connected to top

of curtain with barrel rings. Use grease-sealed bearings or self-lubricating graphite bearings for rotating members.

1. Counterbalance Barrel: Fabricate spring barrel of manufacturer's standard hot-formed, structural-quality, carbon-steel pipe, of sufficient diameter and wall thickness to support rolled-up curtain without distortion of slats and to limit barrel deflection to not more than 0.03 in./ft. of span under full load.
 2. Counterbalance Spring: One or more oil-tempered, heat-treated steel helical torsion springs. Size springs to counterbalance weight of curtain, with uniform adjustment accessible from outside barrel. Secure ends of springs to barrel and shaft with cast-steel barrel plugs.
 3. Torsion Rod for Counterbalance Shaft: Fabricate of manufacturer's standard cold-rolled steel, sized to hold fixed spring ends and carry torsional load.
 4. Brackets: Fabricate from minimum 3/16 inch steel plate with permanently lubricated ball or roller bearings at rotating support points to support counterbalance shaft assembly and form end closures
 - a. Finish: Match door
- G. Hood: Minimum 24 gage galvanized steel formed to fit the curvature of the brackets and contain a waterproof baffle to control air infiltration. Provide intermediate support brackets as required to prevent excess sag.
1. Provide access door when necessary
 2. Finish: Match door.
- H. Door Track Guard: Guard as recommended by Manufacturer to mount to wall. 60 inches AFF.

2.3 OPERATION

- A. Electric door operator assembly of size and capacity recommended and provided by door manufacturer for door and operation-cycles requirement specified, with electric motor and factory-prewired motor controls, starter, gear-reduction unit, solenoid-operated brake, clutch, control stations, control devices, integral gearing for locking door, and accessories required for proper operation.
1. Comply with NFPA 70.
 2. 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.
 3. Usage Classification: Light duty, up to 10 cycles per hour
 4. Motors: Reversible-type motor with controller disconnect switch for motor exposure exterior, wet, and humid. Single phase, 115V, 60hz
 5. 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.
 6. Enclosure type: NEMA 1
 7. 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 inches per second and not more than 12 inches per second, without exceeding nameplate ratings or service factor.

8. Operating Controls, Controllers, Disconnect Switches, Wiring Devices, and Wiring: Manufacturer's standard unless otherwise indicated.
 - a. Push button controls to use the Momentary Control feature.
 9. Coordinate wiring requirements and electrical characteristics of motors and other electrical devices with building electrical system and each location where installed.
 10. Control Station: Three-button control station in fixed location with momentary-contact push-button controls labeled "Open" and "Stop" and sustained- or constant-pressure push-button control labeled "Close."
 - a. Interior Wall Mounted Units: Full-guarded, surface-mounted, heavy-duty type, with general-purpose NEMA ICS 6, Type 1 enclosure.
- B. Obstruction Detection Device: Provide each motorized door with external automatic safety sensor capable of protecting full width of door opening. Activation of sensor immediately stops and reverses downward door travel. Provide the following:
1. Sensor Edge: Provide each motorized door with an automatic safety sensor edge, located within astragal or weather stripping mounted to bottom bar. Contact with sensor immediately stops and reverses downward door travel. Connect to control circuit using manufacturer's standard take-up reel or self-coiling cable.
 - a. Provide pneumatically or electrically actuated automatic bottom bar.
- C. Emergency Manual Operation: Equip each electrically powered door with capability for emergency manual operation. Design manual mechanism so required force for door operation does not exceed 30lbs.
- D. Emergency Operation Disconnect Device: Equip operator with hand-operated disconnect mechanism for automatically engaging manual operator and releasing brake for emergency manual operation while disconnecting motor without affecting timing of limit switch. Mount mechanism so it is accessible from floor level. Include interlock device to automatically prevent motor from operating when emergency operator is engaged.

2.4 LOCKING MECHANISMS

- A. Manual doors shall be secured by chain lock system suitable for a standard padlock system.
- B. Locking Device Assembly: Fabricate with cylinder lock, spring-loaded dead bolt, operating handle, cam plate, and adjustable locking bars to engage through slots in tracks.
 1. Lock Cylinders: Cylinders specified in Division 08 section, Door Hardware and keyed to building keying system.
 2. Keys: Three for each cylinder
- C. Safety Interlock Switch: Equip power-operated doors with safety interlock switch to disengage power supply when door is locked.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify opening sizes, tolerances and conditions are acceptable.
- B. Examine conditions of substrates, supports, and other conditions under which this work is to be performed.
 - 1. Verify conditions are in accordance with approved shop drawings
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Prepare surfaces using the methods recommended by the manufacturer for achieving the results to meet by Performance Requirements.

3.3 INSTALLATION

- A. Install assemblies to provide a rigid, permanent attachment to the building according to manufacturer's instructions and final Shop Drawings, free of springing, forcing, racking, and distortion.
 - 1. Fasten door guide assemblies to adjacent structure with hot-dip galvanized (in accord with ASTM A153) machine bolts and nuts, or expansion or chemical adhesive anchor bolts to meet Performance Requirements
- B. Fit and align assembly including hardware; level and plumb, to provide smooth operation.
- C. Coordinate installation of electrical service with Division 26. Complete wiring from disconnect to unit components.
- D. Coordinate installation of sealants and backing materials at frame perimeter as specified in Division 07 Section, Joint Protection.
- E. Install an additional hood around gears where exposed to view in their final configuration.
- F. Power-Operated Door Assemblies: Install according to UL 325.

3.4 STARTUP SERVICE

- A. Engage a factory-authorized service representative to perform startup service.
 - 1. Perform installation and startup checks according to manufacturer's written instructions.
 - 2. Test and adjust controls and safety devices. Replace damaged and malfunctioning controls and equipment.

3.5 ADJUSTING

- A. Adjust hardware and operating assemblies for smooth, free, effortless, and noiseless operation.
- B. Lubricate bearings and sliding parts as recommended by manufacturer.
- C. Adjust seals to provide weather-tight fit around entire perimeter.

3.6 MAINTENANCE SERVICE

- A. Initial Maintenance Service: Beginning at Substantial Completion, maintenance service shall include 12 months' full maintenance by skilled employees of coiling-door Installer. Include quarterly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for door operation. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.
 - 1. Perform maintenance, including emergency callback service, during normal working hours.

3.7 CLEANING

- A. Following completion of installation, including related work by others, lubricate, test, and adjust doors for ease of operation, free from warp, twist, or distortion and weathertight for the entire perimeter.
- B. Remove labels and visible markings.
- C. Touch-up, repair or replace damaged products before Substantial Completion.

3.8 PROTECTION

- A. Protect installed products until completion of project.

3.9 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to operate and maintain overhead coiling doors.
 - 1. Demonstrate that doors operate in accordance with the manufacturer's requirements and final Shop Drawings
 - 2. Verify operating controls, manual controls, bypass and safety devices are operating

END OF SECTION 08 3323

FINISH HARDWARE
Section 08710

PART I - GENERAL

1.01 WORK INCLUDED

- A. The work in this section shall include furnishing of all items of finish hardware as hereinafter specified or obviously necessary to complete the building, except those items that are specifically excluded from this section of the specification.
- B. Related work specified in other Sections:
 - 1. 08 11 00 Hollow Metal Doors and Frames

1.02 DESCRIPTION OF WORK

- A. Furnish labor and material to complete hardware work indicated, as specified herein, or as may be required by actual conditions at building.
- B. Include all necessary screws, bolts, expansion shields, other devices, if necessary, as required for proper hardware application. The hardware supplier shall assume all responsibility for correct quantities.
- C. All hardware shall meet the requirements of Federal, State and Local codes having jurisdiction over this project, notwithstanding any real or apparent conflict therewith in these specifications.
- D. FASTENERS:
 - 1. Hardware as furnished shall conform to published templates generally prepared for machine screw installation.
 - 2. Furnish each item complete with all screws required for installation. Typically, all exposed screws installation.
 - 3. Insofar as practical, furnished concealed type fasteners for hardware units that have exposed screws shall be furnished with Phillips flat head screws, finished to match adjacent hardware.
 - 4. Door closers and exit devices to be installed with closed head through bolts (sex bolts).
- E. All Finish Hardware to be installed per manufacturer's instructions and with manufacturer's fasteners.

1.03 QUALITY ASSURANCE

- A. The supplier to be a directly franchised distributor of the products to be furnished and have in their employ an AHC (Architectural Hardware Consultant). This person is to be available for consultation to the architect, owner and the general contractor at reasonable times during the course of work.
- B. The finish hardware supplier shall prepare and submit to the architect six (6) copies of a complete schedule identifying each door and each set number, following the numbering system and not creating any separate system himself. He shall submit the schedule for review, make corrections as directed and resubmit the corrected schedule for final approval. Approval of schedule will not relieve Contractor of the responsibility for furnishing all necessary hardware, including the responsibility for furnishing correct quantities.
- C. No manufacturing orders shall be placed until detailed schedule has been submitted to the architect and written approval received.
- D. After hardware schedule has been approved, furnish templates required by manufacturing contractors for making proper provisions in their work for accurate fitting, finishing hardware setting. Furnish templates in ample time to facilitate progress of work.

- E. Hardware supplier shall have an office and warehouse facilities to accommodate the materials used on this project. The supplier must be an authorized distributor of the products specified.
- F. The hardware manufactures are to supply both a pre-installation class as well as a post-installation walk-thru with the general contractor/construction manager, hardware supplier and Manufacturer's representative at the request of the General Contractor/Construction Manager. This is to insure proper installation and provide for any adjustments or replacements of hardware as required using installation manuals, hardware schedule, templates, physical product samples and installation video's, if available.
 - 1. When electrical or pneumatic hardware is specified this meeting shall also include the following trades/installers: Electrical, Security, Alarm systems and Architect.
 - 2. Meeting to convene one week prior to commencing work of this Section.
 - 3. Coordinate with Section 01039
 - 4. The hardware supplier shall include the cost of this seminar in his proposal.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Wrap, protect finishing hardware items for shipment. Deliver to manufacturing contractors hardware items required by them for their application; deliver balance of hardware to job; store in designated location. Each item shall be clearly marked with its intended location.

1.05 WARRANTY

- A. The material furnished shall be warranted for one year after installation or longer as the individual manufacturer's warranty permits.
- B. Overhead door closers shall be warranted in writing by the manufacturer against failure due to defective materials and workmanship for a period of ten (10) years commencing on the Date of Final Completion and Acceptance, and in the event of failure, the manufacture is to promptly repair or replace the defective with no additional cost to the Owner.

PART II - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. To the greatest extent possible, obtain each kind of hardware from only one manufacturer.
- B. All numbers and symbols used herein have been taken from the current catalogues of the following manufacturers.

PRODUCT	ACCEPTABLE MANUFACTURER	ACCEPTABLE SUBSTITUTE
1) Hinges	Ives	Hager, Bommer
2) Locks & Latches	Schlage	Falcon, Best
3) OH Stops/holders	Glynn Johnson	Rixson
4) Kick Plates	Ives	Rockwood
5) Threshold/Weather-strip	Zero	National Guard
6) Silencers	Ives	Glynn Johnson

2.02 FINISH OF HARDWARE:

- A. Exterior Hinges to be Stainless Steel (32D), Overhead Holders to be Satin Chrome (26D), Flat Goods to be Stainless Steel (32D) and the Thresholds to be Mill Finish Aluminum.

2.03 HINGES AND PIVOTS:

- A. Exterior butts shall be Stainless Steel. Butts on all out swinging doors shall be furnished with non-removable pins (NRP).

2.04 LOCKSETS:

- A. For exterior use Locksets shall be Heavy Duty Cylindrical type, Grade 1, unless specified otherwise, in "ND" Series, Sparta Design as manufactured by Schlage Lock Company.
 - 1. Acceptable Substitutions:
 - A. Falcon T series Quantum design
 - B. Best 93K 14H design
- B. All locksets to have VandIGard levers where the locked lever freely rotates up and down while remaining securely locked and increase resistance to over-rotation of the lever.
- C. Locksets shall be Heavy Duty Mortise type, Grade 1, unless specified otherwise, in Schlage L9000 Series, 17A design as manufactured by Schlage lock company
 - 1. Acceptable substitutions:
 - A. Falcon "MA" Series, QG Design
 - B. Best 45H Series 14H Design

2.05 OVERHEAD HOLDERS AND STOPS:

- 1. Overhead holders/stops to be used where wall or floor stops are not useable. Use Glynn Johnson 90 series on exterior openings and high use interior openings and 450 series on interior medium to low use openings.
- 2. Acceptable Substitutions:
 - a. Trimco
 - b. Hager

2.06 TRIM AND PLATES:

- A. Armor plates, shall be .050 gauge with 32D finish. 48" less three (3) inches less than door width. Bevel top edges of all armor plates. All screw holes to be drilled and countersunk in horizontal edges for oval head undercut screws.

2.07 THRESHOLDS ,WEATHERSTRIP ,SWEEPS:

- A. Thresholds to meet handicap requirements. Furnish 5" depth. Furnish full wall opening width when frames are recessed. Cope in front of mullions if thresholds project beyond door faces. Zero type 545.
- B. Weather-stripping – Apply to head and jambs where specified. Zero type 429A
- C. Door Sweeps – Surface Zero type 8198AA
- D. Acceptable Substitutions: Reese, National Guard
- E. Drip Caps to be provided at exterior openings not protected by overhangs. Should be 4" wider than door.

2.08 DOOR SILENCERS:

- A. Furnish rubber door silencers equal to Ives SR64/SR65 for all new interior hollow metal frames, (2) per pair and (3) per single door frame.

PART III - EXECUTION

3.01 INSTALLATION:

- A. All hardware shall be applied and installed in accordance with the Finish Hardware schedule. Care shall be exercised not to mar or damage adjacent work.
- B. Contractor to provide a secure lock-up for hardware delivered to the project but not yet installed. Control the handling and installation of hardware items that are not immediately replaceable, so that the completion of the work will not be delayed by hardware losses both before and after installation.
- C. No hardware is to be installed until the hardware manufactures have provided a pre-installation class. This is to insure proper installation of the specified products.

3.02 ADJUSTING AND CLEANING:

- A. Contractor shall adjust all hardware in strict compliance with manufacturer's instructions. Prior to turning project to owner, contractor shall clean and make any final adjustments to the finish hardware.

3.03 PROTECTION:

- A. Contractor shall protect the hardware, as it is stored on construction site in a covered and dry place.
- B. Contractor shall protect exposed hardware installed on doors during the construction phase.

3.04 HARDWARE SCHEDULE:

- A. Prepare hardware schedule for the single door using the specified items in Part 2 for review by Owner.
- B. Passage lever lockset, with overhead hold/stop and stainless steel armor plate on the inside of door panel.

END OF SECTION

SECTION 08 9100
LOUVERS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes extruded aluminum, prefinished, drainable blade louvers

1.2 DEFINITIONS

- A. Louver Terminology: Refer to AMCA Publication 501 for definitions of terms for metal louvers.

1.3 PERFORMANCE REQUIREMENTS

- A. Minimum Air Performance, Water Penetration, and Air Leakage Ratings: Provide louvers complying with performance requirements indicated as demonstrated by testing manufacturers stock units, of height and width indicated, according to Air Movement and Control Association (AMCA) Standard 500-L.
- B. Airborne Sound Transmission Loss: Provide acoustical louvers complying with airborne sound transmission loss ratings indicated, as demonstrated by testing manufacturer's stock units according to ASTM E 90.
- C. Design aluminum door and frame assemblies in accordance with the FBC. Refer to structural drawings for wind and design pressures.
1. All exterior assemblies shall be compliant with Florida Building Code rule 9N-3 for statewide product approval and require a Florida Product approval number.
- D. Thermal Movements: Provide louvers that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
1. Temperature Change (Range): 120 Deg F ambient, 180 Deg F material surfaces.

1.4 SUBMITTALS

- A. Product Data: Test reports evidencing compliance of units with Performance Requirements.
- B. Shop Drawings:
1. Plans, elevations, sections, and details showing profiles, angles, spacing of louver blades; unit dimensions related to wall openings and construction; free areas for each size indicated; and profiles of frames at jambs, heads and sills.
2. Shop Drawings shall be signed and sealed by a licensed engineer registered in the State of Florida.
3. Wind loading Calculations shall be stamped, sealed and signed by a Professional Engineer in the State of Florida verifying compliance with ASCE 7-10.

- 4. Sample of Approved Product Label and location of attachment to assembly.
 - C. Color selection materials for type of finish specified
 - D. Product certificates signed by louver manufacturers certifying that their products which comply with Project requirements are licensed to bear AMCA Seal based on tests made in accordance with AMCA Standard 500 and complying with AMCA Certified Ratings Program.
- 1.5 QUALITY ASSURANCE
- A. Source Limitations: Obtain louvers and vents from a single source where alike in one or more respects with regard to type, design, and factory-applied color finish.
 - B. SMACNA Standard: Comply with SMACNA "Architectural Sheet Metal Manual" recommendations for construction details and installation procedures.
- 1.6 PROJECT CONDITIONS
- A. Field Measurements: Check openings by field measurements before fabrication; show recorded measurements on final Shop Drawings.
- 1.7 DELIVERY, STORAGE AND HANDLING
- A. Delivery: Visually inspect all materials at time of delivery for damage. Any damaged boxes, crates, louver sections.
 - B. Storage: Per manufacturer's instructions, off ground, covered with a weather proof flame resistant sheeting or tarpaulin.
 - C. Handling: Handle in accordance with manufacturer's instructions

PART 2 - PRODUCTS

2.1 MANUFACTURER

- A. Basis of Design: Greenheck Fan Corporation
- B. Products of the following manufacturers are also acceptable provided compliance with technical requirements.
 - 1. American Warming and Ventilating
 - 2. Airolite Co.
 - 3. Construction Specialties, Inc.
 - 4. Industrial Louvers, Inc.
 - 5. Ruskin Louvers
 - 6. United Enertech Corp.
- C. Refer to Mechanical Drawings for required sizes.

2.2 MATERIALS

- A. Aluminum Extrusions: ASTM B 221, alloy 6063-T5 or T-52.
- B. Aluminum Sheet: ASTM B 209, 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, alloy 319.
- D. Fasteners: 300 Series stainless steel.

- E. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

2.3 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. Maintain equal louver blade spacing to produce uniform appearance.
- C. 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.
- D. Include supports, anchorages, and accessories required for complete assembly.
- E. Where indicated, provide subsills made of same material as louvers for recessed louvers.
- F. Join frame members to each other and to fixed louver blades in accordance with tested assembly and Performance Requirements.

2.4 LOUVERS

- A. Louvers shall be 6 inches deep with 35 degree stationary blades. Blades and frames shall be 0.081 inches extruded aluminum, alloy 6063-T5.
 - 1. Louver shall be fitted with 16 by 18 mesh, 0.063 inches aluminum insect screen in extruded aluminum frames.
- B. Louver blades shall be joined to each side frame and vertical stiffener with two, one inch long fillet Gas Metal Arc Welds with a minimum 1/8 inch throat.
- C. Louvers shall bear AMCA Ratings Seals for air performance and water penetration ratings.
- D. Minimum Free Area: 7.68 sq. ft. per 4' X 4' unit.
- E. Free area velocity: 721 fpm free area velocity at a pressure drop not exceeding .15 inches W.G. per AMCA Standard 500.
- F. Water Penetration: No more than .01 ounces of water per square foot of free area at a free area velocity of 1250 fpm when tested for 15 minutes per AMCA Standard 500.

2.5 ALUMINUM FINISHES

- A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
- C. Fluoropolymer Coating: Manufacturer's standard three-coat, thermo-cured, full-strength 70 percent Kynar 500 FSF resin, 1 mil thick with 0.5-mil clear coat and 30 percent reflective gloss when tested in accordance with ASTM D 523. A 20 year limited warranty against failure of the finish shall begin on the Date of Substantial Completion.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine openings to receive the work. Do not proceed until any 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 level, plumb, and at indicated alignment with adjacent work and in accordance with manufacturer's recommendations to meet Performance Requirements
- B. Erection Tolerances:
 - 1. Maximum variation from plane or location shown on the approved shop drawings: 1/8 inch per 12 feet of length, but not exceeding 1/2 inch in any total building length or portion thereof (noncumulative).
 - 2. Maximum offset from true alignment between two members abutting end to end, edge-to-edge in line or separated by less than 3 inch: 1/16 inch (shop or field joints). This limiting condition shall prevail under both load and no load conditions.
 - 3. Do not erect warped, bowed, deformed or otherwise damaged or defaced members. Remove and replace any members damaged in the erection process as directed.
- C. Cut and trim component parts during erection only with the approval of the manufacturer or fabricator, and in accordance with his recommendations. Restore finish completely. Remove and replace members where cutting and trimming has impaired the strength or appearance of the assembly.

3.4 ADJUSTING AND CLEANING

- A. Clean exposed surfaces of louvers and vents that are not protected by temporary covering, to remove fingerprints and soil during construction period. Do not let soil accumulate until final cleaning.
- B. Before final inspection, clean exposed surfaces with water and a mild soap or detergent not harmful to finishes. Thoroughly rinse surfaces and dry.
- C. Restore louvers and vents damaged during installation and construction so no evidence remains of corrective work. If results of restoration are unsuccessful, as determined by Architect, remove damaged units and replace with new units.
 - 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.
- D. Protect installed materials to prevent damage by other trades.

END OF SECTION 08 9100

SECTION 09 2216
NON STRUCTURAL METAL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes: Non-load-bearing steel framing

1.2 SUBMITTALS

- A. Design analysis data showing design loads and stud gages for each condition.

1.3 QUALITY ASSURANCE

- A. Single-Source Responsibility: Obtain steel framing members for gypsum board assemblies from a single manufacturer.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Store materials inside under cover, dry, and protected against damage.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers:

1. Steel Framing and Furring:
 - a. Clark Dietrich Building Systems
 - b. Consolidated Fabricators Corp.
 - c. Unimast Inc.

2.2 STEEL FRAMING FOR WALLS AND PARTITIONS

- A. Provide steel framing members complying with the following requirements:
1. Component Sizes and Spacings: Comply with ASTM C754 under the following maximum deflection and lateral loading conditions:
 - a. Maximum Deflection at 5 pound-foot per square foot:
 - 1) Painted Interior Partitions: L/240
 2. Protective Coating: G-90 hot-dip galvanized coating per ASTM A653.
- B. Steel Studs and Runners: ASTM C645
- C. Steel Rigid Furring (Hat) Channels: ASTM C645, hat-shaped, 7/8-inch deep, 20 gage.
- D. Fasteners for Metal Framing: Provide fasteners of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel framing and furring members securely to substrates involved; complying with the recommendations of gypsum board manufacturers for applications indicated.
- E. Unless indicated otherwise, metal stud framing shall be formed from the following gage metal. If two conditions apply in the following listing, use the heavier gage:
1. Framed openings (heads and jambs of door and window openings) - 16 gage.

- a. 16 gage studs include both (2) studs at each jamb, full height, and headers.
2. Remaining Metal Studs: Minimum 20 gage necessary to achieve the deflection requirement

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates to which gypsum board assemblies attach or abut, installed hollow metal frames, cast-in-anchors, and structural framing for compliance with requirements for installation tolerances and other conditions affecting performance of assemblies. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 INSTALLING STEEL FRAMING, GENERAL

- A. Steel Framing Installation Standard: Install steel framing to comply with ASTM C 754 and with ASTM C 840 requirements that apply to framing installation.
- B. Install supplementary framing, blocking, and bracing at terminations in gypsum board assemblies to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction. Comply with details indicated and with recommendations of gypsum board manufacturer.
- C. Isolate steel framing from building structure to prevent transfer of loading imposed by structural movement. Use vertical sliding slide clip application or use of deflection track and plate track two-piece system, or slip-joint with U-channel.
 1. Where building structure abuts ceiling perimeter or penetrates ceiling.
 2. Where partition framing and wall furring abut structure, including steel beams, steel joists, at bottom of roof decks and floor decks, except at floor.
 - a. Provide slip-type joints to attain lateral support and avoid axial loading.
 3. Rated Deflection Track: Maintain continuity of fire-resistance-rated assembly indicated.

3.3 INSTALLING STEEL FRAMING FOR WALLS AND PARTITIONS

- A. Install runners (tracks) at floors, ceilings, and structural walls and columns where gypsum board stud assemblies abut other construction.
 1. Where metal framing is installed directly against exterior walls, install asphalt felt strips between studs and wall.
 - a. Metal framing includes Z-furring channels, hat-shaped furring, and metal studs.
- B. Installation Tolerances: Install each steel framing and furring member so that fastening surfaces do not vary more than 1/8 inch from the plane formed by the faces of adjacent framing.
- C. Extend partition framing full height to structural supports or substrates above suspended ceilings, except where partitions are indicated to terminate at

suspended ceilings. Cut studs 1/2 inch short of full height. Continue framing over frames for doors and openings and frame around ducts penetrating partitions above ceiling to provide support for gypsum board.

- D. Install steel studs and furring in sizes and at spacing indicated but not less than that required by the referenced steel framing installation standard to comply with maximum deflection and minimum loading requirements specified.
- E. Install steel studs so that flanges point in the same direction and so that leading edges or ends of each gypsum board can be attached to open (unsupported) edges of stud flanges first.
- F. Frame door openings to comply with details indicated, with GA-219, and with applicable published recommendations of gypsum board manufacturer. Attach vertical studs at jambs with screws either directly to frames or to jamb anchor clips on door frames; install runner track section (for cripple studs) at head and secure to jamb studs.
 - 1. Extend vertical jamb studs through suspended ceilings and attach to underside of floor or roof structure above.
- G. Frame openings other than door openings to comply with details indicated or, if none indicated, in same manner as required for door openings. Install framing below sills of openings to match framing required above door heads.

END OF SECTION 09 2216

SECTION 09 2900
GYPSUM BOARD

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes: Mildew resistant gypsum board

1.2 DEFINITIONS

- A. Gypsum Board Construction Terminology: Refer to ASTM C11 and GA-505 for definitions of terms related to gypsum board assemblies not defined in other referenced standards.

1.3 QUALITY ASSURANCE

- A. Refer to "Recommended Specification on Levels of Gypsum Board Finish" published by the Gypsum Association for finish levels specified.
- B. Single-Source Responsibility:
 - 1. Obtain each type of panel product from a single manufacturer.
 - 2. Obtain finishing materials from or approved by the same manufacturer that supplies panel products.
- C. Replace all board that has become wet at any point prior to the Date of Substantial Completion, including board that has been installed and finished.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Store materials inside under cover, dry, and protected against damage. Stack panels flat to prevent sagging.
- B. Handle panels to prevent damage to edges, ends, and surfaces.
- C. Do not bend or otherwise damage metal trim accessories.

1.5 PROJECT CONDITIONS

- A. Environmental Limitations: Comply with ASTM C840 or with gypsum board manufacturer's recommendations, whichever is more stringent.
- B. Do not install interior products until installation areas are enclosed and conditioned.
- C. Ventilate building spaces as required for drying joint treatment. Avoid drafts during hot dry weather to prevent finishing materials from flash drying.

PART 2 - PRODUCTS

2.1 GYPSUM BOARD PRODUCTS

- A. Provide gypsum board of types indicated in maximum lengths available, minimizing joints.
 - 1. Thickness: Provide gypsum board 5/8-inch thick to comply with ASTM C840 for application system and support spacing indicated.
- B. Gypsum Wallboard: ASTM C1396 and as follows:

1. Type X. Mold resistant where indicated
 2. Edges: Tapered
- C. Mildew Resistant Gypsum Board: ASTM D3273, Score 10
1. DensArmor Plus by Georgia Pacific
 2. Mold Tough By United States Gypsum Company
 3. XP Wallboard by National Gypsum Company
 4. ProRoc with M2Tech by CertainTeed Corporation

2.2 TRIM ACCESSORIES

- A. Interior Trim: ASTM C1047
1. Material: Sheet steel zinc-coated by hot-dip process
 2. Shapes indicated below by reference to Fig. 1 designations in ASTM C1047:
 - a. Cornerbead on outside corners, unless otherwise indicated.
 - b. LC-bead (J-Bead) with both face and back flanges; face flange formed to receive joint compound. Use LC-beads for edge trim unless otherwise indicated.
 - c. L-bead with face flange only; face flange formed to receive joint compound. Use L-bead where indicated.
 - d. U-bead with face and back flanges; face flange formed to be left without application of joint compound. Use U-bead where indicated.
 - e. One-piece control joint formed with V-shaped slot, with removable strip covering slot opening.

2.3 JOINT TREATMENT MATERIALS

- A. General: Complying with ASTM C475
- B. Joint Tape for Panels: Paper
- C. Joint Compound for Mildew Resistant Gypsum Sheathing: Tested in accordance with ASTM D3273, Score 10, and evaluated in accordance with ASTM D3274.

2.4 MISCELLANEOUS MATERIALS

- A. Provide miscellaneous materials for gypsum board construction that comply with referenced standards and manufacturer's recommendations.
- B. Steel drill screws complying with ASTM C1002 for the following applications:
1. Fastening gypsum board to steel members less than 0.03 inch thick.
 2. Fastening gypsum board to gypsum board.
- C. Steel drill screws complying with ASTM C954 for fastening gypsum board to steel members from 0.033 to 0.112 inch thick.

PART 3 - EXECUTION

3.1 APPLYING AND FINISHING GYPSUM BOARD, GENERAL

- A. Comply with ASTM C840.
1. Do not install imperfect, damaged, or damp panels.

- B. Install wall/partition panels to minimize the number of abutting end joints or avoid them entirely. Stagger abutting end joints not less than one framing member in alternate courses of board.
- C. Install gypsum panels together for a light contact at edges and ends with not more than 1/16 inch of open space between panels. Do not force into place.
- D. Locate edge or end joints over supports. Do not place tapered edges against cut edges or ends. Avoid joints at corners of framed openings where possible.
- E. Attach gypsum panels to framing provided at openings and cutouts.
- F. Form control joints and expansion joints with space between edges of adjoining gypsum panels, as well as supporting framing behind gypsum panels.
 - 1. Partitions: Provide vertical control joints spread not more than 30 feet on center in partitions.
- G. Cover both faces of partition framing with gypsum panels in concealed spaces (i.e. above ceilings), except in chase walls that are braced internally.
 - 1. Except where concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. in area.
 - 2. Fit gypsum panels around ducts, pipes, and conduits.
 - 3. Where partitions intersect open concrete coffers, concrete joists, and other structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by coffers, joists, and other structural members; allow 1/4 to 3/8-inch wide joints to install sealant.
- H. Isolate perimeter of non-load-bearing gypsum board partitions at structural abutments, except floors, as detailed. Provide 1/4-inch to 1/2-inch wide spaces at these locations and trim edges with U-bead edge trim where edges of gypsum panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.
- I. Space fasteners in gypsum panels according to referenced gypsum board application and finishing standard and manufacturer's recommendations.

3.2 GYPSUM BOARD APPLICATION METHODS

- A. Single-Layer Application:
 - 1. Partitions/walls: Apply gypsum panels vertically or horizontally. Use maximum length panels to minimize end joints.
 - 2. Fastening Method: Steel drill screws

3.3 INSTALLING TRIM ACCESSORIES

- A. General: For trim with back flanges, fasten to framing with the same fasteners used for panels. Otherwise, fasten trim accessories according to accessory manufacturer's directions for type, length, and spacing of fasteners.
- B. Install corner beads (bullnose beads) at outside corners.

- C. Install edge trim where edge of gypsum panels would otherwise be exposed or semi-exposed. Provide edge trim type with face flange formed to receive joint compound except where other types are indicated.
 - 1. Install LC-bead where gypsum panels are tightly abutted to other construction and back flange can be attached to framing or supporting substrate.
 - 2. Install L-bead where edge trims can only be installed after gypsum panels are installed.
 - 3. Install U-bead where indicated.
- D. All trim, accessories and corner beads shall be installed using screws. "Crimping" tool and staple attachment is not allowed.

3.4 FINISHING GYPSUM BOARD ASSEMBLIES

- A. Apply joint treatment at gypsum board joints (both directions); flanges of corner bead, edge trim, and control joints; penetrations; fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration and levels of gypsum board finish indicated.
- B. Prefill open joints, rounded or beveled edges, and damaged areas using setting-type joint compound.
- C. Apply joint tape over gypsum board joints and to trim accessories with concealed face flanges as recommended by trim accessory manufacturer and as required to prevent cracks from developing in joint compound at flange edges.
- D. Levels of Gypsum Board Finish: Provide the following levels of gypsum board finish per GA-214.
 - 1. Level 0: For temporary construction only.
 - 2. Level 1: For plenum areas above ceilings, attics, and areas where the assembly is concealed.
 - 3. Level 4: For textured finishes, wall coverings, and painted finishes.

3.5 CLEANING AND PROTECTION

- A. Remove any residual joint compound from adjacent surfaces.
- B. Provide final protection and maintain conditions to ensure gypsum board assemblies remain without damage or deterioration at the Date of Substantial Completion.
- C. Remove and replace panels that are wet, moisture damaged, or mold damaged.
 - 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
 - 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 09 2900

SECTION 09 5100
ACOUSTICAL CEILINGS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes acoustical ceilings and related items.

1.2 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an experienced Installer who has successfully completed acoustical ceilings similar in material, design, and extent to that indicated for Project.
- B. Single-Source Responsibility for Ceiling Units: Obtain each type of acoustical ceiling unit from a single source with resources to provide products of consistent quality in appearance and physical properties without delaying progress of the Work.
- C. Single-Source Responsibility for Suspension System: Obtain each type of suspension system from a single source with resources to provide products of consistent quality in appearance and physical properties without delaying progress of the Work.
- D. Fire Performance Characteristics:
1. Surface Burning Characteristics: Tested per ASTM E 84 and complying with ASTM E 1264 for Class A products.
 - a. Flame Spread: 25 or less.
 - b. Smoke Developed: 50 or less.
 2. Identify acoustical ceiling components with appropriate markings of applicable testing and inspecting organization.
- E. Coordination of Work: Coordinate layout and installation of acoustical ceiling units and suspension system components with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system components, and partition system.

1.3 DELIVERY, STORAGE, AND HANDLING

- A. Deliver acoustical ceiling units to project site in original, unopened packages and store them in a fully enclosed space where they will be protected against damage from moisture, direct sunlight, surface contamination, and other causes.
- B. Before installing acoustical ceiling units, permit them to reach room temperature and stabilized moisture content.
- C. Handle acoustical ceiling units to avoid chipping edges or damaging units.

1.4 PROJECT CONDITIONS

- A. Do not install interior acoustical ceilings until space is enclosed and weatherproof, wet work in space is completed and nominally dry, work above ceilings is complete, and ambient conditions of temperature and humidity will be continuously maintained at values near those indicated for final occupancy.

1.5 EXTRA MATERIALS

- A. Furnish 02 percent extra materials of the quantity installed for ceiling panels, suspension system, and hold down clips.

1.6 WARRANTY

- A. Acoustical Panel: Submit a written warranty executed by the manufacturer agreeing to repair or replace acoustical panels that fail within the warranty period. Failures include sagging and warping, and rusting of the suspension system and components.
- B. Warranty Periods:
 - 1. Acoustical Panels: Ten (10) years from the Date of Substantial Completion.
 - 2. Grid: Ten (10) years from the Date of Substantial Completion.
 - 3. Acoustical panels and grid system provided by the same manufacturer shall be warranted for fifteen (15) years from the Date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Acoustical ceiling panels:
 - 1. Armstrong World Industries
 - 2. Certainteed Ceilings
 - 3. USG Interiors Inc.
- B. Acoustical ceiling grid systems:
 - 1. Armstrong World Industries
 - 2. Certainteed Ceilings
 - 3. Donn "DX" by USG Interiors Inc.

2.2 MATERIALS

- A. Acoustical Ceiling Tile: ASTM E 1264 classifications as designated. Tile shall carry the humidity resistant performance characteristics. Finish shall be factory applied, washable, white latex paint, unless noted otherwise.
 - 1. Dune No. 1772 square lay-in, fine texture, 5/8-inch thick by 24-inches by 24-inches with HumiGuard and an NRC of .50
 - 2. Sand Micro No. SHM-157, Trim Edge, light texture, 5/8-inch thick by 24-inches by 24-inches, sag resistant, NRC of .50
 - 3. Office (Square): Astro No. 8221 square lay-in, fine texture, 5/8-inch thick by 24-inches by 24-inches with ClimaPlus and an NRC of .55

2.3 CEILING SUSPENSION SYSTEMS

- A. Suspension systems shall meet or exceed the requirements of ASTM C 635 for dimensional tolerances, coatings and finishes, and load carrying capabilities. Individual component deflection shall not exceed 1/360 of the span.
- B. Finishes and Colors: Provide hot-dipped galvanized finish (G-30 minimum) on all ceiling suspension components. Exposed surfaces of suspension system

components shall receive white baked-on enamel paint.

1. High-Humidity Finish: Comply with ASTM C 635 requirements for "Coating Classification for Severe Environment Performance" at all locations.
- C. Grid Face: 15/16 inch
- D. Wall Channel: Hemmed edge type.
- E. Rough Suspension Materials
 1. Metal Channel Runners: 1-1/2", 475 pounds per thousand lineal feet and 3/4", 300 pounds, per thousand lineal feet, cold rolled painted channels.
 2. Hanger and Tie Wire: Not less than 12 gauge galvanized soft annealed steel.
- F. Attachment Devices: Size for 5 times design load indicated in ASTM C 635, Table 1, Direct Hung, unless otherwise indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and structural framing to which ceiling system attaches. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Coordination: Furnish layouts for preset inserts, clips, and other ceiling anchors whose installation is specified in other sections.
- B. Measure each ceiling area and establish layout of acoustical units to balance border widths at opposite edges of each ceiling. Border to be 12 inches or greater, and comply with reflected ceiling plans.
- C. Laid out grid and coordinate for lighting fixtures and mechanical systems
- D. Application of acoustical treatment shall be done by the manufacturer of his authorized applicator and in strict accordance with the manufacturer's specifications, except as herein modified.
- E. The installation of the ceiling shall be done prior to the installation of shelving, built-in counters, and finished floors; but after the other work in the room has been completed, including painting.

3.3 INSTALLATION

- A. General: Install acoustical panel ceilings to comply with ASTM C 636 and seismic design requirements indicated, according to manufacturer's written instructions and CISCA's "Ceiling Systems Handbook."
- B. Install suspension wires 4 foot on center, maximum, in each direction. Secure suspension hangers to building structure above. For lighting fixtures, install hanger wires to runners at all 4 corners of fixtures. Do not attach hanger wire to metal deck, electrical equipment, mechanical equipment or related support systems.
 1. Maximum splay of hanger wire is 10 degrees and must be offset per

ASTM C 636.

- C. Install metal channel by saddle tying hanger wire or with leveling clips to a leveling tolerance of 1/8" in 12 feet each way.
- D. Install grid suspension system in strict accordance with the manufacturer's recommendations.
- E. Install wall angle at intersection of suspended ceiling and vertical surfaces. Where plenum space occurs above ceiling, apply continuous ribbon of acoustical adhesive or caulking compound on top of vertical wall angle after installation.
- F. Install acoustical units in a true and even plane, in straight line courses following lay out pattern shown in reflective ceiling plan. Fit border units neatly against vertical surfaces.
- G. Seal joints in acoustical units around pipes, ducts, and electrical outlets with caulking compound.
- H. Install edge moldings of type indicated at perimeter of acoustical ceiling area and at locations where necessary to conceal edges of acoustical units.
 - 1. Screw-attach moldings to substrate at intervals not over 16 inches o.c. and not more than 3 inches from ends, leveling with ceiling suspension system to tolerance of 1/8 inch in 12'-0". Miter corners accurately and connect securely.
- I. Install acoustical tile in coordination with suspension system.

3.4 CLEANING

- A. Replace damaged and broken panels.
- B. Clean exposed surfaces of acoustical ceilings, including trim, edge moldings, and suspension members. Comply with manufacturer's instructions for cleaning and touch-up of minor finish damage. Remove and replace work that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.
- C. Just prior to the Date of Substantial Completion, remove and replace skinned, damaged, or dirty tile with new.

END OF SECTION 09 5100

SECTION 09 9000
PAINTING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes painting and finishing work.
- B. The Architect shall not be limited in the number of colors selected for single space or for the complete Project.

1.2 DEFINITIONS

- A. The terms "paint", "protective coating", etc. include paints, special coatings, stains, sealers, fillers, and other types of coatings and coating materials whether used as primers, barrier, intermediate, or finish coats individually or as a system.
- B. Exposed Surfaces: Surfaces exposed to view when permanent or built-in fixtures, covers, grilles, mechanical and electrical equipment housings, ducts and conduits, are in place; surfaces in back of movable equipment and furniture; and interior surfaces of ducts visible through grilles, interior surfaces visible through equipment covers, and blank-off panels.

1.3 SUBMITTALS

- A. Materials List: An inclusive list of required coating materials. Indicate each material and cross reference specific coating, finish system, and application. Identify each material by manufacturer's catalog number and general classification.
 - 1. Prepare coating systems schedule proposed on the basis of the surfaces, types of materials, and their dry film thickness. List the name and product number for the products proposed for each use.
 - 2. This shall in no way be construed as permitting substitution of materials for those specified or approved for this Work by the Architect.
- B. Color Chip Catalog: Provide Architect with a complete current color chip catalog from which colors may be selected. Manufacturers may fulfill this requirement by updating catalog that Architect may presently have in his possession.
- C. Draw Downs: Two 9 x 9 inch samples of each selected color and texture.
- D. Manufacturer's Recommendations: In each case where material proposed is not the material specified or specifically described as an acceptable manufacturer in this Section of these Specifications, submit for the Architect's review the current recommended method of application published by the manufacturer of the proposed material.
 - 1. Manufacturer Inspection report showing the substrate has been reviewed; is properly prepared, and compatible for the scheduled coating system.

1.4 QUALITY ASSURANCE

- A. Applicator Qualifications: Company specializing in performing the work of this section with minimum five years documented experience and approved by manufacturer.

- B. Single Source Responsibility: Provide primers and undercoat materials produced by the same manufacturer as the finish coats.
 - 1. Do not mix products from differing manufacturers unless specifically permitted and accepted in writing by the involved manufacturers. Such acceptance shall not affect printed recommendations or warranties. Provide such acceptances prior to commencing work.
- C. Material Quality: Provide the manufacturer's best quality materials of the various coating types specified. Paint material containers not displaying manufacturer's product identification will not be accepted.
- D. Review other Sections in which primers are provided to ensure compatibility of the total system for various substrates. On request, furnish information on characteristics of finish materials to ensure use of compatible primers.
- E. Codes and Standards: In addition to complying with pertinent codes and regulations, comply with the Painting and Decorating Contractors of America (PDCA) in their "PDCA Industry Standards" unless more stringent requirements are specified in the Contract Documents.
- F. Field Samples:
 - 1. One column, one beam, and one full GWB partition.
 - 2. Locate where directed by Architect and Owner.
 - 3. Accepted sample may remain as part of the work.

1.5 PROJECT CONDITIONS

- A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.
- B. Do not apply materials when the surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer
- C. Do not apply exterior coating during rain, or when relative humidity is outside the humidity ranges required by the paint product manufacturer
- D. Provide adequate lighting during the application of any coating system, minimum level shall be that level that will be required for the intended use of the space.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver paint materials to the job site in their original unopened containers with labels intact and legible at time of use.
- B. Store materials at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in well ventilated area.
 - 1. Provide a 10B:C fire extinguisher in the immediate vicinity of the storage area.
 - 2. Store only the approved materials at the job site and store only in a suitable and designated area restricted to the storage of paint materials and related equipment.
 - 3. Use means necessary to ensure the safe storage and use of paint materials and the safe disposal of waste.

1.7 EXTRA STOCK

- A. Deliver to the Owner 1 gallon of extra stock of each type, color, and gloss of material used. Deliver sufficient unmixed proportions of multi component materials to make minimum 1 gallon of each.
- B. Furnish extra paint materials from the same production run as the materials applied in the Work. Package paint materials in unopened, factory-sealed containers for storage and identify with labels describing contents including location of application.
 - 1. Furnish multi component materials in correct proportions for mixing and label parts respectively.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Products specified are those known suitable for this type of work and are based on products shown on the schedules at the end of this section and require no further approval as to manufacturer or catalog number.
 - 1. Substitution requests shall include manufacturer's literature for each proposed product giving the name, generic type, descriptive characteristics, and independent testing laboratory certification for meeting or exceeding characteristics as listed on data sheets from the design basis products. Systems subject to Architect's approval.
 - 2. Substitute products shall be the highest quality grade of the various types of materials regularly manufactured by the manufacturer for indicated substrates. Substitute products may have to be a different generic type to provide performance comparable to that specified. Materials not displaying the manufacturer's identification as the highest-grade product, or not recommended by the manufacturer's lab as the best and most suitable product will not be accepted.
 - 3. Substitutions which propose decrease the film thickness or fail to meet any of the performance or other characteristics of the design basis materials will not be considered.
- B. Other Acceptable Manufacturers:
 - 1. Benjamin Moore & Company
 - 2. Coronado Paint
 - 3. Duron Paints & Wall Coverings
 - 4. Glidden Professional
 - 5. Devoe High Performance Coatings
 - 6. MAB Paints, M.A. Bruder & Sons, Inc.
 - 7. Pratt and Lambert
 - 8. PPG Paints
- C. Products of the following manufacturers are acceptable as equal to Tnemec, providing their products equal or exceed the quality specified.
 - 1. Carboline Company
 - 2. Amercoat by Arkema (Previously Ameron)
 - 3. Sherwin-Williams

2.2 MATERIALS

- A. Coatings: Ready mixed, except field catalyzed coatings. Prepare pigments:
 - 1. To a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating
 - 2. For good flow and brushing properties
 - 3. Capable of drying or curing free of streaks or sags
 - 4. Interior materials furnished shall produce a surface having a Class A rating for flame, fuel, and smoke.
- B. Accessory Materials: Linseed oil, shellac, turpentine, paint thinners and other materials not specifically indicated but required to achieve the finishes specified; commercial quality.
- C. Material Compatibility: Provide primers, finish coat materials, equipment, and related materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by the manufacturer based on testing and field experience.
 - 1. Coordinate primed or pre-finished products specified elsewhere in these Specifications, assuring compatibility of the total systems.
 - 2. Provide barrier material over suspected noncompatible substrates as recommended by coatings manufacturer. If performance of specified finish system will be compromised due to incompatibility, remove the noncompatible finishes and re-prime. Barrier coat, removal and re-priming to be at no additional cost to Owner.
 - 3. Thinners shall be only those thinners recommended for that purpose by the manufacturer of the material to be thinned.
- D. Materials not specifically indicated but required for preparation, application, or clean-up shall be of high grade commercial quality.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions under which painting work is to be applied. Do not proceed with work until unsatisfactory conditions have been corrected.
- B. Starting of painting work will be constructed as Applicator's acceptance of surfaces and conditions within any particular area.
- C. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions otherwise detrimental to formation of a durable paint surface.
- D. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
- E. Test shop applied primers for compatibility with subsequent cover materials.
- F. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the maximums as recommended, for the types of coatings to be used, by the manufacturer.
- G. Measure pH level in concrete and stucco surfaces for compliance with manufacturer's compatible recommendations.

- H. Take necessary measures to ensure that workers and work areas are protected from fire and health hazards resulting from handling, mixing, and application.

3.2 SURFACE PREPARATION

A. General

1. Perform preparation and cleaning procedures in accordance with paint manufacturer's instructions, and as specified, for each substrate condition.
2. Remove hardware, hardware accessories, machined surfaces, plates, lighting fixtures, and similar items in place prior to surface preparation and painting operations. Following completion of painting of each space or area, reinstall removed items.
 - a. If removal is impractical or impossible because of size or weight of the item, provide surface-applied protection before surface preparation and painting.
3. Before applying paint or other surface treatments, clean substrates of substances that could impair bond of the various coatings. Remove oil and grease before cleaning. Program cleaning and painting so that contaminates from cleaning process will not fall onto wet, newly painted surfaces.

B. Provide barrier coats over incompatible primers or remove and re-prime.

1. Shellac and spot prime with industry accepted "stain killers" at all marks or stains which may bleed through final finishes.

C. Before applying succeeding coats, primers and undercoats shall be integral and shall function as intended. Touch up all scratches, abrasions and other disfigurements and remove any foreign mater before proceeding with the following coat. All spot-priming or spot-coating shall be feathered into adjacent surfaces for a smooth final surface.

D. Do not apply final coats until other work with operations that would be detrimental to finish coats has been completed in that area.

E. When the manufacturing of paint supplied does not require or recommend a primer, and a single coat will provide required coverage, approval from the Architect must be obtained to delete second coat; and a credit shall be due the Owner.

F. Shop Primed Steel and Iron Surfaces: Areas that have had shop prime coat damaged are to be re-prepared by receiving a power tool cleaning (SSPC SP-3), or abrasive blast cleaning (SSPC SP-6) for the respective surface and coating involved. Feather edges to make touch-up patches inconspicuous.

G. Welds: Prepare welds by removing oils, greases, foreign matter, and contaminates in accordance with SSPC SP-1. Remove weld spatter, slag, and flux deposits. Grind surface to a smooth transition. Power tool clean or abrasive blast clean, depending on surface and finish system, areas to adhere primer but not less than 2-inches from the weld.

H. Galvanized Surfaces: Remove surface contamination, oils, and other residuals,

and wash with solvent in accordance with SSPC SP-1. Pretreat in accordance with SSPC PT-2 or apply primer recommended by manufacturer.

- I. Gypsum Board Surfaces:
 - 1. Fill minor defects with filler compound and spot prime defects after repair.
 - 2. Plaster: Fill hairline cracks, small holes, and imperfections with latex patching plaster. Finish smooth and flush with adjacent surfaces.
 - 3. Do not begin paint application until finishing compound is dry and sanded smooth.
- J. Non-Compatible Finishes: Materials or equipment with non-compatible factory finishes shall receive an application of an intermediate or barrier material as required by the manufacturer of finish product. If performance of specified finish system will be compromised due to incompatibility, Architect reserves the right to require removal of factory primer or finish, and application of a new compatible primer. Additional work and materials required by non-compatible finishes shall be provided at no additional cost to Owner.

3.3 MATERIALS PREPARATION

- A. Mix and prepare painting materials in accordance with manufacturer's written instructions.
- B. Store materials not in actual use in tightly covered containers. Maintain containers used in storage, mixing, and application of paint in a clean condition, free of foreign materials and residue.
- C. Stir materials before application to produce a mixture of uniform density and stir as required during application. Do not stir surface film into material. Remove film and, if necessary, strain material before using.

3.4 APPLICATION

- A. General: Apply paint in accordance with manufacturer's directions. Use applicators and techniques best suited for substrate and type of material being applied.
 - 1. Apply additional coats when undercoats, stains, or other conditions show through final coat of paint, until paint film is of uniform finish, color, and appearance. Give special attention to insure that surfaces, including edges, corners, crevices, welds, and exposed fasteners receive a dry film thickness equivalent to that of flat surfaces.
 - 2. Apply material only to clean, dry surfaces and during periods of favorable weather unless otherwise allowed by the manufacturer.
 - 3. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Paint surfaces behind permanently-fixed equipment or furniture with prime coat only before final installation of equipment.
 - 4. Paint front and back sides of access panels and removable or hinged covers to match exposed surfaces.
 - 5. Seal top and bottom edges of wood doors with two coats of shellac or other effective sealer immediately upon delivery of doors to Site and after trimming to size.
 - 6. Finish exterior doors on tops, bottoms, and side edges same as exterior faces unless otherwise indicated.

7. Sand lightly between each succeeding enamel or varnish coat.
- B. Take dry bulb and wet bulb temperature readings when preparing and coating metal surfaces. Do not proceed if conditions are not within the recommended or specified tolerances.
- C. Use a tack rag to tack off all gypsum walls prior to priming.
- D. Brush or roll out and work materials onto surfaces in an even film, free of marks.
- E. Spray Application: Utilize spray application on metal surfaces where hand brush work would be inferior.
 1. Each application shall provide the equivalent hiding of brush-applications. Do not double back with spray equipment for the purpose of building up film thickness in one pass.
 2. Backroll all applications on stucco surfaces.
- F. Make each application to provide a uniform finish, distinctively darker than the proceeding. Make edges adjoining other materials or colors sharp and clean, without overlapping. Sand between applications with fine sandpaper or rub surfaces with pumice stone in accordance with manufacturer's directions, where required to produce a smooth even finish.
- G. Scheduling Painting: Apply first coat material to surfaces that have been cleaned, pretreated, or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration.
 1. Allow sufficient time between successive coatings to permit proper drying. Do not recoat until paint has dried to where it feels firm, does not deform or feel sticky under moderate thumb pressure, and application of another coat of paint does not cause lifting or loss of adhesion of the undercoat.
 2. Slightly vary the color of succeeding coats.
- H. Paint Film Thickness: Make as many applications of material as necessary to obtain the minimum dry film thickness recommended by the manufacturer. Rate of application shall not exceed manufacturer's recommendations for each coat.
- I. Prime Coats: Apply prime coat of material which is required to be painted or finished and which has not been prime coated by others.
 1. Recoat primed and sealed surfaces where there is evidence of suction spots or unsealed areas in first coat, to assure a finish coat with no burn through or other defects due to insufficient sealing.
 2. Coordinate manufacturer's prime coats with finish coats as specified herein. If compatibility is not ascertained during the bidding period, and verification submitted with the shop drawings, then prime coat paint system as specified herein shall be applied to the item prior to finish painting as specified herein.
- J. Pigmented Finishes: Completely cover to provide an opaque, smooth surface of uniform finish, color, appearance, and coverage. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections will not be acceptable.
 1. If undercoats or other conditions show through topcoat, apply additional

coats until cured film has a uniform paint finish, color, and appearance.

- K. Completed Work: Match approved samples for color, texture, and coverage. Remove, refinish, or repaint work not in compliance with specified requirements.

3.5 FINISHING MECHANICAL AND ELECTRICAL EQUIPMENT

- A. Paint shop primed equipment. Paint shop finished items when shop finish is damaged. Galvanized items are not considered pre-finished and are to be painted when visible (outside mechanical/electrical closets).
- B. Prime and paint insulated and non-insulated pipes, conduit, boxes, insulated and non-insulated ducts, hangers, brackets, collars and supports exposed to view.
- C. Prime and paint exposed to view mechanical and electrical equipment occurring in finished areas, in addition to manufacturers paint finish if any.
 - 1. Paint interior surfaces of ducts, where visible through registers or grilles, with a flat, nonspecular black paint.
 - 2. Refer to Mechanical and Electrical Sections for schedule(s) of stencil identification and banding for equipment, ductwork, piping, and conduit in accordance with ANSI requirements. Consult Architect for resolution of color or identification conflicts.
- D. Paint both sides and edges of plywood backboards for electrical and telephone equipment with fire-retardant finish before installing backboards or equipment.

3.6 FIELD QUALITY CONTROL

- A. Work is subject to inspection by the Architect, Owner, or their representative(s) at any time.
 - 1. Owner may engage the services of a qualified testing agency to sample paint materials being used. Samples of material delivered to Site will be taken, identified, sealed, and certified in presence of Contractor.

3.7 CLEAN-UP AND PROTECTION

- A. Remove from Site discarded paint materials, rubbish, cans, and rags at end of each work day.
- B. Upon completion of painting work clean window glass and other paint-spattered surfaces. Remove spattered paint by proper methods of washing and scraping, using care not to scratch or otherwise damage finished surfaces.
- 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. Provide "Wet Paint" signs as required to protect newly painted finishes.
- D. At the completion of Work of other trades, touch-up and restore damaged or defaced painted surfaces.

3.8 PAINT TYPES AND NUMBER OF COATS

- A. The following schedules are intended to identify the type of finishes which are required for the various surfaces, and to identify the surfaces to which each finish is to be applied.

1. Where the substrate has a compatible and satisfactory prime coat already on it, the prime coat specified for the numbered finish may be omitted. Test prime coat for compatibility before applying additional coats.
 2. When the manufacturing of paint supplied does not require or recommend a primer, and a single coat will provide required coverage, approval from the Architect must be obtained to delete second coat; with a credit.
- B. To define requirements for quality, function, and textures, the following list of materials designates the manufacturer's brand, types, and other requirements to conform to the requirements of this Project.

3.9 EXTERIOR PAINTING SCHEDULE

A. Ferrous Metal:

1. High-Build Acrylic Polyurethane Enamel:

- a. Primer: Metal primer applied at spreading rate recommended by the manufacturer.

- 1) Tnemec: Poxiprime Series N69
- 2) S/W: Recoatable Epoxy Primer (B67 Series)
- 3) Glidden Professional: Devran 223 Universal Epoxy Prime
- 4) Benjamin Moore: Corotech V150 Epoxy Primer

- b. Second Coat: Epoxy intermediate coat applied at spreading rate recommended by the manufacturer.

- 1) Tnemec: Series 66 Hi-Build Expoxoline
- 2) S/W: Acrolon 218 HS with SG Hardner (B65 Series)
- 3) Glidden Professional: Bar Rust 231 Multi-Purpose Epoxy Mastic (231KXXXX)
- 4) Benjamin Moore: Corotech V160 Epoxy Mastic

- c. Third Coat: Semigloss, acrylic polyurethane enamel applied at spreading rate recommended by the manufacturer.

- 1) Tnemec: Series 1075 Endura-Shield
- 2) S/W: Acrolon 218 HS with SG Hardner (B65 Series)
- 3) Glidden Professional: Devthane 378 Aliphatic Urethane Semi-Gloss Enamel (378KXXXX)
- 4) Benjamin Moore: Corotech V510 Aliphatic Urethane

- d. Surfaces: Bollards.

B. Ferrous Metal:

1. Alkid Enamel:

- a. Primer: Metal primer applied at spreading rate recommended by the manufacturer.

- 1) Sherwin-Williams: Kem Kromik Universal Metal Primer B50Z Series
- 2) Duron: Universal Phenolic Alkyd Fast Dry

- 3) Glidden Professional: Metal Primer
Devgard Rust Penetrating Alkyd
Metal Primer (4160/4360)
- 4) Benjamin Moore Alkyd Metal Primer P06
- 5) Insl-x Corotech V140 Alkyd Metal Primer
- b. Second and Third Coat: Semigloss, enamel applied at spreading rate recommended by the manufacturer.
 - 1) Sherwin-Williams: Industrial Enamel, B54 Series.
 - 2) Glidden Professional: Devguard Alkyd Gloss Enamel (4308)
 - 3) Benjamin Moore DTM Alkyd Semi-Gloss P24
 - 4) Insl-x Corotech V201 Urethane Alkyd S/G Enamel
- c. Surfaces: Hollow metal doors, frames.
- d. Paint both interior and exterior side of hollow metal doors and frames.
- e. Primer may not be required on shop-primed items. Confirm in writing with the manufacturer of the type of shop primer being applied. Surface preparation shall be as recommended by the painting materials manufacturer.

3.10 INTERIOR PAINTING SCHEDULE

A. Concrete Floor Paint:

- 1. Water based acrylic floor paint: Coating to withstand hard ware, abrasion, grease, oils and cleaning equipment.
 - a. Primer:
 - 1) Sherwin-Williams: Armorseal Tread-Plex Primer
 - 2) Glidden Professional: Concrete Bond Enhancer (3111)
 - 3) Benjamin Moore Latex Floor & Patio N122
 - b. Second and Third Coats:
 - 1) Sherwin-Williams: Armorseal Tread-Plex
 - 2) Glidden Professional: Concrete Coatings (3610)
 - 3) Benjamin Moore Latex Floor & Patio N122
 - c. Surfaces: Colored line paint.

B. Gypsum Board:

- 1. Acrylic-Latex Finish:
 - a. Primer: Latex-based, interior primer applied at spreading rate recommended by the manufacturer.
 - 1) Sherwin-Williams: Vapor Barrier Primer 154-6407
 - 2) Glidden Professional: Vapor Barrier Primer-Sealer (1060)
 - 3) Benjamin Moore Super Spec Vapor Barrier Primer 260
 - b. First and Second Coats: Semigloss, acrylic-latex, interior enamel

applied at spreading rate recommended by the manufacturer.

- 1) Sherwin-Williams: ProMar 200 Latex Semi-Gloss B31W200
- 2) Glidden Professional: ULTRA-HIDE 150 Latex Semi-Gloss (1416v)
- 3) Benjamin Moore Ultra Spec 500 Semi-Gloss N539
- 4) Coronado SuperKote 5000 Latex Semi-Gloss (32-1)

- c. Surfaces: Gypsum board walls, bulkheads, ceilings, where epoxy is not indicated.

C. Electrical Equipment Backer Boards:

1. Fire Retardant Coating:

- a. Sherwin-Williams: Flame Control No. 20-20 flat Intumescent Fire Retardant Paint
- b. Glidden Professional: Flame Control No. 20-20 flat Intumescent Fire Retardant Paint
- c. Duron: Flame Control No. 20-20 flat Intumescent Fire Retardant Paint
- d. Insl-x LFR110 Flat Intumescent Fire Retardant Paint

D. Ferrous Metal: refer to Metal Building section for structural steel coating system.

END OF SECTION 09 9000

SECTION 10 1400
SIGNAGE

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Exterior building letters

1.2 SUBMITTALS

- A. Samples: Exterior building letters.

1.3 DELIVERY, STORAGE, AND HANDLING

- A. Deliver signage to the Site in protective wrap to prevent damage. Store in a dry area, protected from the elements.

PART 2 - PRODUCTS

2.1 MANUFACTURER

- A. Exterior building letters, shall be as manufactured by one of the following:
 1. Vital Signs of Orlando, Inc.
 2. Sign Design of Florida, Inc.
 3. Environmental Graphics, Inc.
 4. Innerface Architectural Signage
 5. Commercial Signs & Graphics
 6. Signs Plus
 7. APCO Graphics, Inc.
 8. ASI Sign Systems
 9. Best Sign Systems

2.2 EXTERIOR BUILDING LETTERS

- A. 16 inches high, 2 inches deep letters, 3/4-inch stand out, aluminum, black anodized. Color as selected by Architect.
- B. Letter Style: Futuri, all caps
- C. Material: Cast aluminum
- D. Installation Method: Pin mounted, 3/4 inch from wall
- E. Provide a clear back on building letters
- F. Verify actual copy and layout with Owner and Architect prior to fabrication
- G. Provide mounting and installation kits for mounting building letters.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Inspect both the substrate and conditions under which Work is to be performed. Do not proceed until unsatisfactory conditions have been corrected in an acceptable manner.
- B. Secure Work true to line and level. Allow for building expansion.
- C. Visual Effects: Provide uniform joint widths in exposed Work. Arrange joints in

exposed Work to obtain the best visual effect. Refer questionable choices to the Architect for final decision.

- D. Isolate incompatible material as necessary to prevent deterioration.

END OF SECTION 10 1400

SECTION 10 4400
FIRE PROTECTION SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes:
 - 1. Fire extinguishers
 - 2. Fire extinguisher mounting brackets

1.2 SUBMITTALS

- A. Product data for cabinets include rough-in dimensions, details showing mounting methods, relationships of box and trim to surrounding construction, door hardware, cabinet type and materials, trim style, door construction, panel style, and materials.

1.3 QUALITY ASSURANCE

- A. Single-Source Responsibility: Obtain extinguishers and cabinets from one source from a single Manufacturer.
- B. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."
- C. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers:
 - 1. J.L. Industries
 - 2. Larsen's Manufacturing Co.
 - 3. Nystrom
 - 4. Potter-Roemer, Inc.

2.2 FIRE EXTINGUISHERS

- A. Provide fire extinguishers for each cabinet and other locations indicated, in colors and finishes selected by Architect from manufacturer's standard that comply with authorities having jurisdiction.
 - 1. Multipurpose Dry Chemical Type: UL-rated 4-A:60-B:C, 10-lb nominal capacity, in enameled steel container.
- B. All fire extinguishers shall have a current inspection tag and an expiration date of at least eleven months after the Date of Substantial Completion.

2.3 MOUNTING BRACKETS

- A. Brackets: Designed to prevent accidentally dislodging extinguisher, of sizes required for type and capacity of extinguisher indicated, in plated finish.
 - 1. Provide stainless steel brackets for extinguishers not located in cabinets.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine walls and partitions for thickness and framing for cabinets to verify cabinet depth and mounting prior to cabinet installation.
- B. Do not proceed until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Follow manufacturer's printed instructions for installation.
- B. Install in locations and at mounting heights indicated or, if not indicated, at heights to comply with applicable regulations of governing authorities.
 - 1. Prepare recesses in walls for cabinets as required by type and size of cabinet and style of trim and to comply with Manufacturer's instructions.
 - 2. Fasten mounting brackets and cabinets to structure, square and plumb.
 - 3. Mounting Height: 54 inches maximum above finished floor to the top of box, making top of bottle at 48 inches AFF.

END OF SECTION 10 4400

SECTION 10670 - METAL SHELVING, LOCKERS, WORK TABLE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Conditions of the Contract and Division 1, as indexed, apply to this Section.

1.2 SCOPE

- A. Supply and install all Metal Shelving Systems as shown on Drawings and as specified herein.
- B. Metal Lockers
- C. Not used.
- D. Work Table
- E. Other Misc. Items Specified and shown on the drawings.

1.3 GUARANTEE

A. Per General Conditions.

1.4 SUBMITTALS

- A. Manufacturer's data.
- B. Submit two samples of color selected and hardware for acceptance by Architect.

PART 2 - PRODUCTS

2.1 MANUFACTURER

- A. Republic Storage Systems Company, Inc., 1038 Beleden Avenue, N.E., Conton, Ohio 44705, 1(800) 477-1255.
- B. Pemco Products, Inc. (800) 562-1000
- C. Northern Tool + Equipment
- D. Or accepted equal.

2.2 PRODUCTS

- A. Locker (Republic) or accepted equal

1. Standard lockers, double tier 12" wide x 15" deep x 42"
2. End finishing panels
3. Number plates
4. 16GA Zee base, 4" high
5. Color: "Decorator Tan"
6. Flat top corner filler

B. Not used

C. Storage Shelving

1. Wide span shelving units, 30" deep 2 shelf units high. Base 2 shelf unit and rack end unit 60" wide. See plan for quantity. #20383 +20018C. Each unit includes :
 - a. 1 upright frame
 - b. 2 steel shelf levels
 - c. 2 pair side shelves supports
 - d. 2 pair rigidity beams
 - e. 1 rack ending kit
2. Color: "Decorator Tan"

D. Work Bench (Republic) or accepted equal

1. Seven (7), 60"x30", 12 gauge steel 1 3/4" top with 1/8" tempered hardboard bonded to steel top. Adjustable straight legs, model # M183158 global industrial equipment 1-800- 645-1232, Republic Work Bench, Adjustable Legs, 13 gauge top, 14 gauge legs, 16 gauge stringers, 18 gauge base shelve, 16 gauge back, 12gauge foot , tempered hardboard kit with 20 gauge trim or acceptable equal.
2. Color: "Decorator Tan"

PART 3 - EXECUTION

3.1 MEASUREMENTS

- A. Verify all dimensions shown on Drawings by taking field measurements; proper fit and attachment of all parts is required.

3.2 COORDINATION

- A. Coordinate with all other trade whose Work relates to metal locker installation for placing of all required blocking, subframing, backing, furring, etc., to insure proper locations.

3.3 DELIVERY AND STORAGE

- A. Deliver and store materials in dry, protected areas. Keep free of corrosion or other damage. Replace any damaged parts at no cost to Owner.

3.4 INSTALLATION

- A. Install all lockers per manufacturer's published instructions and approved installation layouts. Secure to back wall through metal stud with wood sleepers.
- B. Install all shelves as per manufacturer's published instructions and approved layouts. Secure units to floor and wall purlings.
- C. Install all work bench per manufacturer's instructions.

3.5 CLEAN-UP

- A. Per General Conditions.

END SECTION 10670



SECTION 11450 - RESIDENTIAL & ICE MAKER EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Conditions of the Contract and Division 1, as indexed, apply to this Section.

1.2 SCOPE

A. Supply and install all Residential Equipment as shown on Drawings and as specified herein.

1.3 SAMPLES

A. Per General Conditions, submit two samples of color selected and hardware for accepted by Architect.

1.4 GUARANTEE

A. Per General Conditions.

1.5 SUBMITTALS

A. Manufacturer's data

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. Amana Refrigeration Corporation, Amana, Iowa 52204, 1-800-843-0304.

B. Hotpoint, Louisville , Kentucky 40225, 1-800-626-2000.

C. General Electric Company, Louisville, Kentucky 40225, 1-800-633-4888.

D. Manitowoc, 2110 South 26th Street, Manitowoc, WI 54221-1720 920-682-0161

2.2 PRODUCTS

A. Under wall cabinet Microwave oven. GE, JVM240AV, Color Almond, or acceptable equal.

B. Refrigerator, GE, TBX22JAX, Color Almond, or acceptable equal.

- C. Ice maker with storage bin, see drawings for manufacturer.
- D. Ice Cube Machine, Manitowoc, Indigo Series 450 ICE Cube Machine. With Half Dice, 115/60/1 or architect's approved equal.

2.3 COLOR

- A. Almond/Beige- Residential appliances
- B. Staniless Steel- Ice Cube Machie

PART 3 - EXECUTION

3.1 MEASUREMENTS

- A. Verify all dimensions shown on Drawings by taking field measurements; proper fit and attachment.

3.2 COORDINATION

- A. Coordinate with all other trade whose Work relates to residential equipment metal locker installation for placing of all required blocking, subframing, backing, furring, etc., to insure proper locations.

3.3 DELIVERY AND STORAGE

- A. Deliver and store materials in dry, protected areas. Keep free of corrosion or other damage. Replace any damaged appliance at no cost to Owner.

3.4 INSTALLATION

- A. Install all equipment as per manufacturer's published instructions and accepted installation layouts.

3.5 CLEAN-UP

- A. Per General Conditions.

END SECTION 11450



SECTION 12 3216
MANUFACTURED PLASTIC-LAMINATE-CLAD CASEWORK

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes plastic laminated faced modular casework constructed to AWI 1600.

1.2 SUBMITTALS

- A. Shop Drawings:
 - 1. Details and sizes including methods of attachment
 - 2. Show locations for support in metal stud walls.
 - 3. Type and locations for support within walls
 - 4. Field verified dimensions
 - 5. Indicate utility locations to be coordinated with other trades
- B. Samples
 - 1. Full range of colors, textures, and patterns available for plastic laminate and edging.
- C. Quality Standard: Comply with the Architectural Woodwork Standard, Latest Edition for grades of interior architectural woodwork, construction, finishes and other requirements.
- D. Sample Guarantee

1.3 JOB CONDITIONS

- A. Deliver casework only after wet work is complete and relative humidity is maintained within manufacturer's recommended range for one week. Store in ventilated spaces. Protect against damage during installation through the Date of Substantial Completion.
- B. Take field measurements for casework items. Show measurements on Shop Drawings.

1.4 QUALITY ASSURANCE

- A. Defective workmanship or damaged components shall be corrected, repaired, or replaced as requested by the Architect, without further cost to the Owner.
- B. Manufacturer Qualifications: Minimum 7 years experience in the manufacturer and installation of the type of cabinets specified.
- C. Installer Qualifications: Minimum 5 years experience in the installation of the type of cabinets specified.
- D. Coordinate delivery of templates and other similar items from other trades necessary for the construction of required casework units.
- E. Casework shall be manufactured and install to meet the requirements of the FBC and the Florida Fire Prevention Code.
- F. Quality Standard: Comply with requirements of "Architectural Woodwork Quality Standards" published by the Architectural Woodwork Institute (AWI).

- G. Comply with Section 1600 "Modular Cabinets" and Section 1700 "Installation of Woodwork" of the Architectural Woodwork Institute's Architectural Woodwork Quality Standards.

1.5 WARRANTY

- A. 3 years from the Date of Substantial Completion against defects in material and workmanship. Cover repair or replacement, without cost to the Owner, of items that become defective within the 3-year period. Exception: Damage caused by improper operation or misuse.

1.6 FLORIDA ACCESSIBILITY CODE FOR BUILDING CONSTRUCTION

- A. Casework shall conform with the Accessibility Requirements Manual from the Florida Department of Community Affairs, Florida Board of Building Codes and Standards.

PART 2 - PRODUCTS

2.1 GENERAL WORKMANSHIP

- A. Machine parts for accurate fit and assemble with appropriate fasteners and adhesives to result in true, square, level, and plumb units.
- B. Coordinate with other trades for required dimensions of items to be built into casework.
- C. Provide removable or false backs for access or concealment of heating or plumbing items.
- D. Scribe tops and backsplashes to walls and other adjoining vertical surfaces.
- E. Cabinets at end walls shall have minimum scribe unless shown otherwise.

2.2 MATERIALS

- A. Plastic Laminate
 - 1. Acceptable Manufacturers: Wilsonart, Pionite, Formica, and Nevamar
 - 2. Decorative Laminates
 - a. High-pressure decorative laminate VGS (.028), NEMA LD 3
 - b. High-pressure decorative laminate HGS (.048), NEMA LD 3
 - c. High-pressure cabinet liner CLS (.020), NEMA LD 3
 - d. High-pressure backer BKH (.028) NEMA LD 3
 - 3. Exposed horizontal surfaces: HGS
 - 4. Exposed, interior and exterior vertical surfaces: VGS
 - 5. Backing sheet for concealed surfaces: BKH or CLS for balanced panel.
 - 6. Backing sheet for semi-exposed surfaces: BKH
 - 7. Color (all surfaces): Selected by Architect.
- B. Edging Material
 - 1. High impact PVC or ABS extrusion, with satin finish
 - 2. Door and Drawer Fronts: 3mm, machine profile to 1/8 inch radius
 - 3. Horizontal and Vertical Front Cabinet Members: 1mm thick
 - 4. Colors: Selected by Architect

C. Core Materials:

1. Particleboard: Composite panel, ½ inch to 1 inch thickness, 100% annually-renewable agricultural fibers, with no added urea formaldehyde, ANSI A208.1-1999 M-3. Below are examples only:
 - a. Agrifiberboard™
 - b. Collins Pine Particleboard
 - c. Woodstalk™
 - d. Encore™
 - e. EnvironmentCore™
 - f. PremiumBlend™
 - g. PrimeBoard Supreme Wheat
 - h. Pine FreeForm®
2. Softwood Plywood: PS 1
3. Hardboard: ANSI A135.4, Class 1 tempered per ASTM D 1037, smooth 2 sides (S2S).
4. Hardwood: Solid lumber concealed members to be kiln dried, select Poplar, Fir, or mill option lumber.
5. Hardwood Plywood: Baltic Birch 7-ply, with no added urea formaldehyde cabinet grade.

2.3 HARDWARE AND MISCELLANEOUS

A. Hinges:

1. Steel, institutional 5 knuckle with interlaying leaves, 270-degree swing, hospital tipped with non-removable pins fastened with 4 screws each leaf into faces. No edge fastening allowed.
2. Thickness .090 inch minimum
3. Doors 48 inches and over shall have 3 hinges per leaf
4. Finish: Powder coat baked-on enamel, color as selected by Architect.

B. Pulls:

1. Bent wire, brushed stainless steel or brushed aluminum
2. Accurately position on drawer and door fronts
3. Through fastened with machine screws
4. Provide 2 pulls for drawers more than 24 inches in width.

C. Drawer Glides:

1. Manufacturer's standard, epoxy coated metal, nylon rollers, 100 pounds dynamic load or European style, bottom mounted, captive profile, epoxy finished, nylon rollers, and 100 pounds dynamic loading with positive in-stop and out-stop.
2. Provide outstop and outkeeper to maintain drawer in 80 percent open position.
3. File drawers and paper storage drawers: Same as above except full extension and load rating static position to be no less than 125 pounds.

- D. Adjustable Shelf Supports: Molded nylon or nickel, 2 pin, anti-lift, minimum 200 pounds capacity support clip. Support to accept either ¾ inch or 1-inch thick shelf.

- E. Catches: Magnetic type, adjusted for maximum 5-pound pull. Attach with screws and slotted for adjustment.

2.4 CABINET CONSTRUCTION

- A. Cabinet Base: 4-inch high, 3/4 inch CDX plywood. Provide additional center support for cabinets over 24 inches wide.
- B. Base, Wall, and Tall Cabinet Boxes
 - 1. Sides, bottom, and top: Constructed of glued and spline doweled 3/4 inch particleboard providing balanced construction, surfaced with cabinet liner CLS for semi-exposed and vertical grade laminate for exposed locations.
 - 2. Wall cabinet bottoms and tops: Constructed of glued and spline doweled one inch thick particleboard, providing balanced construction surfaced with vertical grade laminate for exposed locations and cabinet liner CLS for semi-exposed locations.
 - 3. Intermediate support rail: Minimum 3/4 inch particleboard, surfaced with vertical grade laminate of balanced construction, glued and doweled into cabinet sides.
 - 4. Hanger Rails: Two located at top and bottom of cabinet back, 3 on tall cabinets, locate at top, bottom, and center.
- C. Fixed and Adjustable Shelves and Dividers
 - 1. One inch (particleboard) shelves
 - 2. Exposed Locations: Vertical grade plastic laminate both sides. Color to match cabinet exterior plastic laminate or as selected by Architect.
 - 3. Semi-exposed locations: VGS or CLS
 - 4. Front and back leading edges shall be edged with flat 1mm thick high impact PVC edging to match shelf color.
 - 5. Number of adjustable shelves provided, unless indicated otherwise on the Drawings or on the Schedule
 - a. Low and tall cabinets
 - 1) 1 up to 24 inches: 4 up to 72 inches
 - 2) 2 up to 36 inches: 5 up to 84 inches
 - 3) 3 up to 60 inches: 6 up to 96 inches
 - b. Wall hung cabinets
 - 1) 0 up to 24 inches: 2 up to 36 inches
 - 2) 1 up to 30 inches: 3 up to 40 inches
 - 6. Adjustable dividers: 1/4 inch minimum thickness, prefinished tempered hardboard or plywood, smooth both faces, retained by molded plastic support clip.
 - 7. Fixed dividers: Constructed of 3/4 inch particleboard, surfaced with vertical grade laminate, providing balanced construction; glued and spline doweled. PVC edged to match laminate or adjacent PVC edging.
- D. Cabinet Doors
 - 1. 3/4 inch particleboard
 - 2. High pressure plastic vertical grade laminate exterior and interior.

3. Doors 48 inches and less in length shall have 2 hinges per door; doors over 48 inches in length shall have 3 hinges per door.
 4. Corners: Square with radiused edges, 3mm PVC edging.
- E. Drawers
1. Manufacturers standard construction of minimum components listed below; or high density fiber board; glued and doweled or dovetail jointed; surfaced with vertical grade laminate of balanced construction. Bottoms constructed of minimum 1/4-inch tempered hardboard, surfaced to match drawer sides, inset and glued to four sides.
 2. Drawer Face
 - a. Constructed of minimum 3/4-inch particleboard, surfaced with VGS, screw attached to the drawer box.
 - 1) Corners: To match doors.
 - 2) Edging: To match doors.
 - 3) Plastic Laminate: To match doors.
 3. File Drawers: File drawers shall be constructed in accordance with standard drawers specified above with the following: Include front-to-back and side-to-side hanger file capability with hanger channel for letter size files integral with file drawer sides and 3/16-inch by 1/2-inch removable steel channel to span side-to-side for legal size hanging files.
- F. Solid Surfacing Countertops: Homogeneous filled solid polymer; not coated, laminated, or of a composite construction; meeting IAPMO Z124.3 and IAPMO Z124.6 Requirements.
1. Fire Hazard Ratings classified in accordance local codes and ordinances, ASTM E84 and the following:
 - a. Class A
 - b. Flame Spread: 0 – 25
 - c. Smoke Developed: 0-450
 2. Colors: Architect may choose any color(s) from Color Group A, Color Group B, and Color Group C.
- G. Sealants: Fully bed and seal splashes to tops and to other splashes with Dow Corning 786 Mildew Resistant Silicone Sealant, clear; or Architect approved equal.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Examine conditions under which casework will be installed. Do not proceed with installation until all unsatisfactory conditions have been corrected.
- B. Condition casework to conditioned space prior to installation.

3.2 INSTALLATION

- A. Install woodwork to comply with AWI Section 1700 for the same grade specified in Part 2 of this Section for type of woodwork involved.

- B. Set and Secure cabinetwork and finish carpentry items in place rigid, plumb, and square.
 - 1. Scribe and cut woodwork to fit adjoining work, and refinish cut surfaces and repair damaged finish at cuts.
 - 2. When necessary to scribe on site, make material with ample allowance for cutting.
 - 3. 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 for exposed fastening, countersunk and filled flush with woodwork and matching final finish if transparent finish is indicated.
 - 4. Use purpose designed fixture attachments for mounted components.
 - 5. Counter-sink semi-concealed anchorage devices used to wall mount components and conceal with solid plugs of species to match surrounding wood. Place flush with surrounding surfaces.
 - 6. All wood mounting devices or wood frame work in contact with concrete or masonry shall be pressure treated.
- C. Permanently fix cabinet bases to floor using appropriate components.
- D. Cabinets: Install without distortion so doors and drawers fit openings and are aligned. Adjust hardware to center doors and drawers in openings.
 - 1. Install cabinets to a tolerance of 1/8 inch in 12'-0 for plumb and level and with no variations in flushness of adjoining surfaces.
- E. Countertops: Anchor by screwing through corner blocks of base cabinets or other supports into underside of countertop.
 - 1. Install countertops with no more than 1/8 inch in 12'-0 for plumb and level and with no variations in flushness of adjoining surfaces.
 - 2. Secure backsplashes to walls with adhesive.
 - 3. Calk space between backsplash and wall with sealant specified in Division 07 Section, Joint Protection.
- F. Trim: Install with minimum number of joints possible, using full length pieces (from maximum length lumber available) to the greatest extent possible. Do not use pieces less than 36 inches long, except where necessary.
- G. Install fixtures and accessories supplied under other sections for installation. Install items in accordance with manufacturer's instructions.

3.3 ADJUSTMENT AND CLEANING

- A. Adjust casework and hardware so that doors and drawers operate smoothly and within accessibility requirements.
- B. Install a chain on doors where door will hit an obstruction before it is fully opened.
- C. End cabinets placed against corners or where they tee into other cabinets or obstacles shall be provided with chain or bracket stops on the inside of the doors to prevent the door or door handles from hitting the obstruction.
- D. Clean exposed surfaces, edges, and interiors, and remove construction and installation marks prior to the Date of Substantial Completion.

END OF SECTION 12 3216

SECTION 13 3419
METAL BUILDING SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes pre-engineered building, including, but is not limited to:
 - 1. Pre-engineered structural frame system including tapered columns.
 - 2. Pre-engineered structural roof panel system.
 - 3. Metal wall panels
 - 4. Gutters, downspouts, trim and flashings.
 - 5. Steel frames for roof openings.
 - 6. Exterior doors, windows, and overhead door framing
 - 7. Vinyl faced roof insulation.
- B. Doors and Frames: Shall be in accordance with Division 08 Section, Hollow Metal Doors and Frames.
- C. Overhead Doors and Frames: Shall be in accordance with Division 08 Section, Overhead Coiling Doors.

1.2 BUILDING DESCRIPTION

- A. Provide a complete, integrated set of 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.
- B. Primary Structural: Frames shall consist of welded up plate section columns and roof beams complete with splice plates for bolted field assembly. All bolts for field assembly of primary structural system shall be high-strength bolts.
 - 1. Beam and post endwall frames shall consist of endwall corner posts, rigid frames, endwall roof beams, and endwall posts as required by design criteria.
 - 2. Columns shall be welded tapered "H" sections and sized such that they will fit within the space allotted in the Architectural drawings.
 - 3. Connection of all major structural members shall be made with A325 high-tensile bolts through prepunched or predrilled holes for alignment.
 - 4. All structural steel shall be prepared and factory primed.
 - 5. Sidewalls of the main structure shall have vertical X-bracing as required by the design criteria in the stairwells located in the four corners of the structure.
- C. Secondary Structural: Purlins or girts, eve struts, and framed openings factory primed.

1.3 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer to design metal building system.
- B. Design members to withstand dead load, vertical and horizontal seismic loads, and design loads due to pressure and suction of wind calculated in accordance with ASCE 7-10.

- C. Maximum allowable member deflection and drifts shall be in accordance with the serviceability requirement of ASCE 7-10.
- D. Provide drainage to exterior for water entering or condensation occurring within wall or roof system.
- E. Size and fabricate wall and roof systems free of distortion or defects detrimental to appearance or performance.
- F. Structural Performance: Metal building systems shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated according to procedures in MBMA's "Metal Building Systems Manual."
 - 1. Design Loads: As indicated on Drawings.
 - 2. Deflection and Drift Limits: No greater than the following:
 - a. Purlins and Rafters: Vertical deflection of 1/240 of the span.
 - b. Girts: Horizontal deflection of 1/240 of the span.
 - c. Design secondary-framing system to accommodate deflection of primary framing and construction tolerances, and to maintain clearances at openings.
 - d. Lateral Drift: Maximum of 1/200 of the building height.
 - e. Mezzanine Level Framing: Vertical deflection of 1/240 of the span (DL + LL) and 1/360 of the span (LL only).
 - 3. Support Displacements: Primary superstructure systems shall be designed to accommodate anticipated total and differential settlements of 1 inch and 1/2 inch, respectively.
 - 4. Vibration Serviceability Criteria: The mezzanine level framing system shall be designed to accommodate foot-traffic excitation in an Assembly Occupancy and its calculated peak acceleration shall be less than or equal to 0.50% of gravitational acceleration.
 - 5. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
 - 6. Thermal resistance of Wall System: R-Value of 6.5 continuous outside framing and R-13 between framing.
 - 7. Thermal Resistance of Roof System: R-Value of 20.

1.4 SUBMITTALS

- A. AISC Certification: Submit proof of AISC Certification.
- B. Product Data: Product information, specifications, and published details for building components, accessories.
- C. Shop Drawings: Indicate components by others. Include full building plan, elevations, sections, details and the following:
 - 1. Anchor-Rod Plans: Submit anchor-rod plans and templates before foundation work begins. Include location, diameter, and minimum required projection of anchor rods required to attach metal building to

- foundation. Indicate column reactions at each location.
2. Structural-Framing Drawings: Show complete fabrication of primary and secondary roof and mezzanine level framing; include provisions for openings. Indicate welds and bolted connections, distinguishing between shop and field applications. Include transverse cross- sections.
 - a. Show roof-mounted items including equipment supports and items mounted on roof curbs.
 - b. Include all aspects of the structural system and the building envelope including roofing, wall panels, insulation, windows, doors, gutters, downspouts, and flashings.
 - c. Shop drawings shall be sealed by a professional engineer registered in the State of Florida.
 3. Indicate components locations of interior and exterior primers
- D. Samples: Manufacturer's color samples
- E. Delegated-Design Submittal: For metal building systems.
1. Include analysis data indicating compliance with performance requirements and design data signed and sealed by the qualified professional engineer registered in the State of Florida responsible for their preparation.
- F. Certifications:
1. Dealer Certification: Certify the building system supplier is a manufacturer's authorized and franchised dealer of the system to be furnished. State date authorization was granted.
 2. Installer Certification: Certify the building installer has been regularly engaged in the installation of buildings systems of the same or equal construction to the system specified.
 3. 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, mezzanine floor loads, roof 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.

- G. Welding Certificates
- H. 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. Non-shrink grout.
- I. Source quality-control reports.
- J. Field quality-control reports.
- K. Sample warranties

1.5 QUALITY ASSURANCE

- A. AISC Certification: Building System Manufacturer shall be American Institute of Steel Construction.
- B. Erector Qualifications: An experienced erector who has specialized in erecting and installing work similar in material, design, and extent to that indicated for this Project and who is acceptable to manufacturer.
- C. Material Testing: In addition to mill certifications of structural steel, provide, upon request, evidence of compliance with specification through testing independent of the manufacturer's suppliers. This quality assurance testing to include structural bolts, nuts, screw fasteners, mastics, and metal coating (primers, metallic coated products, and painted coil products).
- D. Welding Qualifications: Qualify procedures and personnel according to the following:
 - 1. AWS D1.1, "Structural Welding Code – Steel."
- E. Design Loads
 - 1. Governing Design Code: Structural design for the building structural system shall be provided by the building manufacturer in compliance with the 2015 edition of the Epcot Building Code with the 2016 Supplement.
 - 2. Roof Live Load: Roof live loads are loads produced during the life of the structure by moveable objects.
 - 3. Wind Load: Wind Pressure Coefficients and the design pressures shall be applied per 2015 edition of the Epcot Building Code with the 2016 Supplement; See Structural Drawings for wind and design pressures.
 - 4. Dead Load: The weight of the building system construction, such as roof, framing, and covering members.
 - a. Dead load calculations shall include the criteria for the 2 ton crane. Refer to Division 14 Section, Overhead Hoist System.
 - 5. Collateral Load: Additional imposed loads required by the contract documents other than the weight of the metal building system. These added loads could include such items as sprinklers, mechanical, electrical and ceiling systems.
 - 6. Auxiliary Loads: All dynamic loads required by the contract documents such as suspended partition walls and kitchen hoods.

7. Load Combinations: Load combinations used to design primary and secondary structural members shall be according to the governing code.
- F. Structural Design Practice - Deflections
1. Calculations for deflections shall be done using only the bare frame method. Reductions based on engineering judgment using the assumed composite stiffness of the building envelope shall not be allowed. Drift shall follow AISC's "Serviceability Design Considerations for Low-Rise Buildings" and the design criteria indicated in the drawings which ever is worse. The use of composite stiffness for deflection calculations is permitted only when actual calculations for the stiffness are included with the design for the specific project. Deflection calculations shall be included in the design data submittals.
- G. Roof System Design - Roof panels shall be designed in accordance with AISI "Specifications for the Design of Light-Gage, Cold-Formed Steel Structural Members."
1. Air Infiltration: Air leakage through assembly of not more than 0.06 cfm/sq.ft. of roof area when tested according to ASTM E 1680 at the following test-pressure difference:
 - a. Test-Pressure Difference: Negative 1.57 lbf/sq.ft.
 - b. Positive Preload Test-Pressure Difference: Greater than or equal to 15.0 lbf/sq.ft. and the greater of 75 percent of building live load or 50 percent of building design positive wind-pressure difference.
 - c. Negative Preload Test-Pressure Difference: 50 percent of design wind-uplift-pressure difference.
 2. Water Penetration: No water penetration when tested according to ASTM E 1646 at the following test-pressure difference:
 - a. Test-Pressure Difference: 2.86 lbf/sq.ft.
 - b. Positive Preload Test-Pressure Difference: Greater than or equal to 15.0 lbf/sq. ft. and the greater of 75 percent of building live load or 50 percent of building design positive wind-pressure difference.
 - c. Negative Preload Test-Pressure Difference: 50 percent of design wind-uplift-pressure difference.

1.6 WARRANTIES

- A. Furnish a written 20 year weathertightness warranty from the Date of Substantial Completion against perforation of metal roof and wall panels due to corrosion under normal weather and atmospheric conditions. Metal roofing system manufacturer and wall panel manufacturer shall sign warranty.
1. Warranty shall include, but not be limited to, metal roofing, fascias, roof insulations and attachments, flashings, cap flashings, closures and trims, fasteners, accessories, sealants, gutters, and watertight connection to downspouts.
 2. Warranty shall not be limited by windloading less than the design windloading and wind uplift. Include a wind warranty rider up to the designed wind and design pressures.
- B. Provide manufacturer's standard paint film written warranty for twenty (20) years

from Date of Substantial Completion against cracking, peeling, chalking, and fading of the coating on painted, painted roof panels and soffit panels. Warranty shall be signed by building system or roof system manufacturer.

1. This warranty covers the "Galvalume" base bid roof system finish or the alternate Kynar 500 FSF roof system finish.
- C. Inspection and Report Services: Metal roof system manufacturer or his authorized agent shall perform an inspection of the entire roof system and shall submit a written report to the Owner detailing all conditions requiring maintenance and repair by parties under the above warranties. Inspections and reports shall be performed once every other year over the twenty (20) year weathertightness warranty period. Cost of Inspection and Report Services shall be included in the contract amount.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis of Design: Butler Manufacturing Company
- B. Products of the following manufacturers are also acceptable provided compliance with technical requirements as specified.
 1. Varco-Pruden
 2. American Buildings Company
 3. MBCI, Inc.
 4. Ceco Building Systems
 5. Nucor Building Systems
 6. Trident Building Systems
 7. Vulcan Steel Structures

2.2 GENERAL

- A. Structural system design shall be a clear or multi-span rigid frame with tapered columns, and roof beams with gable and mono-slope roofs.
- B. Actual building lengths and widths shall be structural line to structural line, coordinated with Drawings.
- C. Roof Slope: Minimum of 1/4 inch in 12 inches to a maximum of 4:12. Refer to Drawings.
- D. Field modification of parts shall be in accordance with the best standard procedures and require written signed and sealed approval from the manufacturer.
- E. Foundations
 1. Show foundations including anchor bolt embedment length on Shop Drawings, in accordance with the best recommended practices for the specific soil conditions of the building site.
 - a. All reactions for the design of foundations shall be supplied by metal building manufacturer. Do not submit reams of reactions from every possible load combination. The reactions shall be culled down to only the worse case scenarios.
 2. Anchor bolt diameter shall be as specified by manufacturer's standard

anchor bolt layout drawings.

2.3 STRUCTURAL STEEL DESIGN

- A. All structural mill sections or welded-up plate sections shall be designed in accordance with the AISC "Specification for the Design, Fabrication and Erection of Structural Steel for Buildings", and all cold-formed steel structural members shall be designed in accordance with the AISI "Specification for the Design of Cold-Formed Steel Structural Members".
- B. Include electrical and mechanical hanging loads and all other items that are supported from the metal building system. Coordinate with all other Contract Documents. Extra costs for this work will not be allowed.

2.4 PRIMARY FRAMING

- A. Rigid Frames
 - 1. Frames shall consist of welded-up plate section columns and roof beams complete with necessary splice plates for bolted field assembly.
 - a. All base plates, cap plates, compression splice plates and stiffener plates shall be factory welded into place and have the connection holes shop fabricated.
 - b. Columns and roof beams shall be fabricated complete with holes in webs and flanges for the attachment of secondary structural members and bracing except for field work as noted on shop Drawings.
 - 2. All bolts for field assembly of frame members shall be high strength bolts as indicated on erection drawings.
- B. Endwall Structurals
 - 1. Endwall structurals shall be welded-up plate sections designed in accordance with the AISC Specification.
 - 2. Endwall frames shall be rigid frames consisting of endwall corner posts, endwall roof beams, endwall wind beams and endwall posts as required by design criteria.
 - a. All splice plates and base clips shall be shop fabricated complete with bolt connection holes. All base plates, cap plates, compression splice plates and stiffener plates shall be factory welded into place and have the connection holes shop fabricated.
 - b. Beams and posts shall be ship fabricated complete with holes for the attachment of secondary structural members except for field work as noted on manufacturer's erection drawings.
 - 3. Intermediate frames shall be substituted for endwall roof beams when specified.
 - a. Necessary endwall posts and holes for connection to the intermediate frame used in the endwall shall be shop fabricated.

2.5 SECONDARY STRUCTURAL MEMBERS

- A. Purlins and Girts
 - 1. Purlins and Girts: Roll formed

2. Girts: 8" or 9-1/2" "Z" shaped or channel sections
 3. Purlins: 8" or 9-1/2" deep "Z" shaped sections
 4. Outer flange of all girts shall contain factory-punched holes for panel connections. Optional girts are also acceptable without factory punched holes for panel connections.
 5. Outer flange of purlins shall contain factory-punched holes for panel connections. Optional purlins are also available without factory punched holes for panel connections on ribbed roof systems only.
- B. Eave Struts: Same depth as purlins.
- C. Bracing
1. Bracing shall be located as indicated on Drawings.
 2. Diagonal bracing shall be hot-rolled rod of size as required by design.
 3. Optional pinned base portal frames may be substituted for wall rod bracing on buildings as required.
 4. Flange braces and purlin braces, when required, shall be cold formed and installed as indicated in the submittals.

2.6 WELDING

- A. Welding procedure and operator qualifications and welding quality standards shall be in accordance with the American Welding Society structural welding code. Inspection other than visual inspection as defined by AWS paragraph 8.15.1, shall be identified and negotiated prior to bidding.

2.7 STRUCTURAL PAINTING

- A. General
1. All structural steel shall be prime painted as temporary protection against ordinary atmospheric conditions. Others shall perform subsequent finish, painting, if required, in the field.
 2. Prior to painting all steel shall be cleaned of loose rust, loose mill scale, dirt and other foreign material. Unless otherwise specified, the fabricator shall not sand blast, flame clean or pickle prior to painting.
- B. Factory Priming
1. Conditioned Spaces: Factory cover all steel with one coat of red oxide primer paint formulated to equal or exceed the performance requirements of Federal Specification TT-P-636D, TT-P-664C, and SSPC Paint-25.
 2. Non-Conditioned Spaces: Tnemec "Poxiprime II, Series N68". Steel shall be SP-6, Commercial Blast Cleaned, prior to application of primer. Equal products by Ameron or Carboline are also acceptable. Architect will make final decision as to product equality.
- C. Primary Frames
1. Clean all steel per SSPC-SP2.
 2. Apply one coat of water reducible alkyd primer by spray or dip method to a minimum coating thickness of 1.0 mil.
- D. Secondary Structurals
1. Clean all steel per SSPC-SP8.
 2. Apply one coat of coil applied polyester primer to a minimum coating

thickness of 0.5 mil. (Purlins and girts).

2.8 ROOF SYSTEM

- A. A. Metal Roof System: Butler Manufacturing “MR-24®” roof system, or equal.
- B. Roof System Design:
 - 1. Design roof panels in accordance with AISI North American Specification for the Design of Cold-Formed Steel Structural Members.
 - 2. Design roof paneling system for a minimum roof slope of 1/4 inch in 12 inches.
 - 3. Design roof paneling system to support design live, snow, and wind loads.
 - 4. Endwall Trim and Roof Transition Flashings: Allow roof panels to move relative to wall panels and/or parapets as roof expands and contracts with temperature changes.
- C. Roof System Performance Testing:
 - 1. UL Wind Uplift Classification Rating, UL 580: Class 90.
 - 2. Structural Performance Under Uniform Static Air Pressure Difference: Test roof system in accordance with ASTM E 1592.
 - 3. Roof system has been tested in accordance with U.S. Army Corps of Engineers Unified Facilities Guide Specification Section 07 61 13.
 - 4. FM Global (Factory Mutual):
 - a. Roof system has been tested in accordance with FMRC Standard 4471 and approved as a Class 1 Panel Roof.
 - b. Metal Building System Manufacturer: Provide specific assemblies to meet required wind rating in accordance with FM Global.
 - c. Installation modifications or substitutions can invalidate FM Global approval.
- D. Roof Panels:
 - 1. Factory roll-formed, 24 inches wide, with 2 major corrugations, 2 inches high (2-3/4 inches including seam), 24 inches on center.
 - 2. Flat of the Panel: Cross flutes 6 inches on center, perpendicular to major corrugations in entire length of panel to reduce wind noise.
 - 3. Variable Width Panels:
 - a. For roof lengths not evenly divisible by the 2'-0" panel width, factory-manufactured variable-width (9-inch, 12-inch, 15-inch, 18-inch, and 21-inch-wide) panels shall be used to ensure modular, weathertight roof installation.
 - b. Minimum Length: 15 feet.
 - c. Supply maximum possible panel lengths.
 - 4. Panel Material and Finish:
 - a. 24-gauge galvanized steel, G90 coating, ASTM A 653, G90.
 - b. Paint with exterior colors of “Butler-Cote” finish system, full-strength, 70 percent “Kynar 500” or “Hylar 5000” fluoropolymer (PVDF) coating.
 - c. PVDF Coating Warranty: Metal building system manufacturer shall warrant coating for 25 years for the following.

- 1) Not to peel, crack, or chip.
 - 2) Chalking: Not to exceed ASTM D 4214, #8 rating.
 - 3) Fading: Not more than 5 color-difference units, ASTM D 2244.
5. Panel Material and Finish: Special materials, gauges, or colors as applicable for custom designs.
 6. Use panels of maximum possible lengths to minimize end laps.
 7. Extend eave panels beyond structural line of sidewalls.
 8. Factory punch panels at panel end to match factory-punched holes in eave structural member.
 9. Panel End Splices: Factory punched and factory notched.
 10. Panel End Laps: Locate directly over, but not fastened to, a supporting secondary roof structural member and be staggered, to avoid 4-panel lap-splice condition.
 11. End Laps: Floating. Allows roof panels to expand and contract with roof panel temperature changes.
 12. Self-Drilling Fasteners: Not permitted.
 13. Ridge Assembly:
 - a. Design ridge assembly to allow roof panels to move lengthwise with expansion and contraction as roof panel temperature changes.
 - b. Factory punch parts for correct field assembly.
 - c. Install panel closures and interior reinforcing straps to seal panel ends at ridge.
 - d. Do not expose attachment fasteners on weather side.
 - e. Use lock seam plug to seal lock seam portion of panel.
 - f. High-Tensile Steel Ridge Cover: Span from panel closure to panel closure and flex as roof system expands and contracts.
- E. Provision for Expansion and Contraction:
1. Provision for Thermal Expansion Movement of Roof Panels: Clips with movable tab.
 - a. Stainless Steel Tabs: Factory centered on roof clip when installed to ensure full movement in either direction.
 - b. Maximum Force of 8 Pounds: Required to initiate tab movement.
 - c. Each Clip: Accommodates a minimum of 1.25-inch movement in either direction.
 2. Roof: Provide for thermal expansion and contraction without detrimental effects on roof panels, with plus or minus 100-degree F temperature difference between interior structural framework of building and of roof panels.
- F. Fasteners:
1. Make connections of roof panels to structural members, except at eaves, with clips with movable stainless steel tabs, seamed into standing seam side lap.
 2. Fasten panel clips to structural members with "Scrubolt" fasteners in accordance with erection drawings furnished by metal building system manufacturer, using factory-punched holes in structural members.

- a. Fasteners: Metal-backed rubber washer to serve as torque indicator.
 3. Exposed fasteners penetrating metal roof membrane at the following locations do not exceed the frequency listed:
 - a. Basic Panel System: 0 per square foot.
 - b. High Eave Trim, No Parapet: 2 per linear foot.
 - c. Exterior Eave Gutter: 2 per linear foot.
 - d. Panel Splices: 2 per linear foot.
 - e. Gable Trim: 0 per linear foot.
 - f. High Eave with Parapet: 0 per linear foot.
 - g. Ridge: 0 per linear foot.
 - h. Low Eave Structural: 1.5 per linear foot.
 - G. Accessories:
 1. Accessories (i.e., ventilators, gutters, fascia): Standard with metal building system manufacturer, unless otherwise noted and furnished as specified.
 2. Exterior Metal Coating on Gutters, Downspouts, Gable Trim, and Eave Trim: "Butler-Cote" finish system, full-strength, 70 percent "Kynar 500" or "Hylar 5000" fluoropolymer (PVDF) coating.
 3. Location of Standard Accessories: Indicated on erection drawings furnished by metal building system manufacturer.
 4. Material used in flashing and transition parts and furnished as standard by metal building system manufacturer may or may not match roof panel material.
 - a. Parts: Compatible and not cause corrosive condition.
 - b. Copper and Lead Materials: Do not use with Galvalume panels.
 - H. Energy Conservation:
 1. Insulate purlins (optional) to eliminate "thermal short circuits" between purlins and roof panels.
 2. Minimize heat loss (thermal short circuit) caused by compression of blanket insulation between structural members and roof panels by use of thermal block at each purlin location
- 2.9 WALL PANEL SYSTEM
- A. Exterior Metal Wall System: Butler Manufacturing Butlerib II wall system or equal. (PBR by MBCI)
 - B. Wall System Design: Design wall panels in accordance with CSA – S136 North American Specification for the Design of Cold-Formed Steel Structural Members.
 - C. Wall Panels:
 1. Roll-formed panels, 3 feet wide with 4 major corrugations, 1-1/2 inches high, 12 inches on center, with 2 minor corrugations between each of the major corrugations entire length of panel.
 2. One piece from base to building eave.
 3. Upper End of Panels: Fabricate with mitered cut to match corrugations of "Butlerib II roof panels of 1/2 inch to 12 inches and square cut for all other roof panels and slopes.
 4. Factory punch or field drill wall panels at panel ends and match factory-

punched or field-drilled holes in structural members for proper alignment

- D. Panels shall be prefinished 50 ksi steel per ASTM A792.
 - 1. 24 gage Galvalume® panels finished with full strength Kynar 500 FSF coating as specified above are acceptable.
 - 2. Galvalume sheet shall be produced in accordance with ASTM A792 and shall have a coating designation of AZ55.
 - 3. Oil coating shall be kept at a minimum. Clean panels of all oil prior to shipment.
 - 4. Use clean, dry gloves during handling and installation.
 - 5. Care shall be exercised to prevent the roofing panels from sliding over each other during shipment and installation.
- E. Fluoropolymer Coating: Manufacturer's standard three-coat, thermo-cured, full-strength 70 percent Kynar 500 FSF resin, 1 mil thick with 0.5-mil clear coat and 30 percent reflective gloss when tested in accordance with ASTM D 523. A 20 year limited warranty against failure of the finish shall begin on the Date of Substantial Completion.
- F. Fasteners:
 - 1. Wall Panel-to-Structural Connections: Torx-head "Scrubolt fasteners.
 - 2. Wall Panel-to-Panel Connections: Torx-head self-drilling screws.
 - 3. Fastener Locations: Indicated on erection drawings furnished by metal building system manufacturer.
 - 4. Exposed Fasteners: Factory painted to match wall color.
- G. Accessories:
 - 1. Accessories (i.e., doors, windows, louvers): Standard with metal building system manufacturer, unless otherwise noted and furnished as specified.
 - 2. Location of Standard Accessories: Indicated on erection drawings furnished by metal building system manufacturer.

2.10 GUTTERS, DOWNSPOUTS, TRIM AND FLASHINGS

- A. All exterior trim shall be the same finish as the roof panels specified above.
- B. Flashings, trim, closures, and similar items shall be as detailed on Drawings and supplied by the manufacturer.
- C. Gutters, downspouts, trim, and flashings shall be 24 gage galvanized steel, except that downspouts from grade level to 8 foot minimum shall be 16 gage.
 - 1. Brackets and spacers for gutters and downspouts shall be 12 gage, spaced at 24" o.c.
- D. Pre-engineered building manufacturers shall size downspouts in accordance with State and local codes.
- E. Provide precast concrete splashblocks for downspouts where shown on Drawings. (For use with downspouts not tied into an underground storm sewer system, whether or not shown on the Drawings.) Precast concrete splashblocks shall be 3000 psi concrete, minimum 18" wide by 24" long.

2.11 INSULATION

- A. Roof insulation: WMP-30 with a white polypropylene film, a blend of fiberglass

and polyester yarn reinforcement and 11# Kraft paper. The facing shall be adhered to Owens-Corning Fiberglas Certified R (NAIMA 202) fiberglass insulation blanket. The assembly of blanket and facing shall have a flame spread rating of less than 25 and a U.L. label furnished upon request.

1. 6 inches thick

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Inspect both the substrate and conditions under which Work is to be performed. Do not proceed until unsatisfactory conditions have been corrected.
- B. Install pre-engineered building, components, accessories, gutters and downspouts, roof panels, wall panels, insulation, and all related items in strict accordance with Shop Drawings and manufacturers written installation instructions.
 1. Coordinate installation with other trades.

3.2 FRAMING

- A. Erect framing in accordance with AISC Specification.
- B. Provide for erection and wind loads. Provide temporary bracing to maintain structure plumb and in alignment until completion of erection and installation of permanent bracing.
- C. Set column base plates with non-shrink grout to achieve full plate bearing.
- D. Do not field cut or alter structural members without written approval of Architect.
- E. After erection, prime welds, abrasions, and surfaces.
- F. All steel shall be clean and free of mud, dirt, and debris at completion of erection.

3.3 ROOFING SYSTEMS

- A. Install in accordance with manufacturer's instructions and final Shop drawings, meeting Performance Requirements.
- B. Exercise care when cutting prefinished material to ensure cuttings do not remain on finish surface.
- C. Fasten cladding system to structural supports, aligned level and plumb.
- D. Locate end laps over supports. End laps minimum 2 inches. Place side laps over bearing.
- E. Provide expansion joints where required by the manufacturer and as may be indicated.
- F. Use concealed fasteners.
- G. Install sealant and gaskets to prevent weather penetration.

3.4 WALL PANELS

- A. Metal Wall System Installation:
 1. Install wall system in accordance with metal building system manufacturer's instructions at locations indicated on the Drawings.

2. Install wall system weathertight.
3. Verify structural system is plumb before wall panels are attached.
4. Align and attach wall panels in accordance with erection drawings furnished by metal building system manufacturer.
5. Install side laps with minimum of 1 full corrugation.
6. Seal wall panels at base with metal trim and foam or rubber closures.
7. Exterior Trim: Apply same finish as exterior color of wall panels, except the following:
 - a. Gutters, Downspouts, Eave Trim, Gable Trim, Door-Side Flashings, and Header Flashings: Paint with full-strength, 70 percent "Kynar 500 FSF" coating.
 - b. Windows: Factory paint aluminum extrusions (thermally broken).
8. Flashings, Trim, Closures, and Similar Items: Install as indicated on erection drawings furnished by metal building system manufacturer.

3.5 ERECTION - ACCESSORIES

- A. Install door frame, door, overhead door, and window.
- B. Seal wall and roof accessories watertight and weather tight with sealant in accordance with Section 07 9000 – Joint Protection.

3.6 ERECTION TOLERANCES

- A. Framing Members: 3/16 inch from level; 1/8 inch from plumb.

3.7 GUTTER AND DOWNSPOUT

- A. Rigidly support and secure components. Joint lengths with formed seams sealed watertight. Flash and seal gutters to downspouts.
- B. Apply bituminous paint on surfaces in contact with cementitious materials.
- C. Slope gutters minimum 1/4 inch/ft.
- D. Connect downspouts to storm sewer system where indicated.
- E. Install splash blocks under each downspout that empties on grade.

3.8 ACCESSORIES

- A. Seal roof accessories watertight and weather tight with sealant in accordance with Division 07 Section, Joint Protection and as recommended by the pre-engineered building manufacturer.

END OF SECTION 13 3419

SECTION 14460 OVERHEAD HOIST SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

- A. To the extent shown on the drawings and specified here in. Provide and install a complete hoist system.
- B. The incomplete description is as follows:
 - 1. 2 ton close headroom cross mounted hoist.
 - 2. Motor driven trolley suspension system.
 - 3. Reeving, 2 Part Double.
 - 4. Hook Bolts.
 - 5. Structural Steel I-beam.
 - 6. 4 heavy duty bumper stops.
 - 7. 2 heavy duty runway rails, 2 Structural Steel I-beams for runway rail support.

1.2 REFERENCES

- A. The publications listed below form a part of these specifications.
- B. Crane Manufacturers Association of America, Inc., CMAA # 74, "Specifications for Top Running and Underrunning, Single Girder Electric Overhead Traveling Cranes".
- C. National Electric Code latest edition.
- D. Florida Building Code and Amendments, latest edition.
- E. National Safety and Health Act, ASHA Section 1910.179 and 1910.309 as applicable to Single Girder Cranes.
- F. A.I.S.C. "Code of Standard Practice of Steel Buildings and Bridges"
- G. A.I.S.C. " Specifications for the Design, Fabrication and Erection of Structural Steel for Building", including the "Commentary" and supplements thereto issued.

H. A.W.S.D-1.1 "Structural Welding Code".

I. A.I.S.C. "Specifications for Structural Joints using A.S.T.M. A-325 or A-490 Bolts", approved by the Research Council on Riveted and Bolted Structural Joints of the Engineering Foundation.

1.3 INSTALLER

A. Installer shall have documented experience in the installation of bridge crane/hoist.

1.4 SUBMITTALS

A. Submit 6 copies of the following in accordance with Section 01300, Submittals.

B. Manufacturer 's Catalog Data: hoist, materials

C. Drawings: Submit sufficient details to verify installation method and compliance with requirements.

D. Certification: Provide complete structural drawings showing sizes/configuration and connections of steel. These documents shall be prepared and sealed by a Florida Registered Structural Engineer.

E. Operation & Maintenance Manual.

PART 2 - PRODUCTS

2.1 BRIDGE CRANE

A. "Wright", 2 Ton, Cross Mounted, Motor Driven Trolley Suspension, 2 Part Double Reeving, Frame 30, **240V, Single Phase**, 60 Hz or accepted equal.

2.2 BRIDGE CRANE STRUCTURE

A. The Bridge girder shall be sized for proposed static and dynamic loads from A-36 steel Wide Flange sections.

B. The Runway Beam shall be sized for proposed static and dynamic loads from A-36 steel Wide Flange sections.

C. Provide A.S.C.E. steel rails.

D. Misc Structural steel: Provide steel Cap Channels , Misc. Hook Bolts, Misc Steel angles, and any other structural steel shape and connectors for a complete installation.

2.3 BUMPER STOPS

- A. Heavy Duty Bumper Stops, ASCE, Type IHB2, Minimum of four.

2.4 BRIDGE DRIVES

- A. Drive units mounted on each end truck (CMAA-A4) -dual drive.
- B. All reductions shall be straight spur gearing and all gears have heat treated full depth teeth with a twenty degree pressure angle.
- C. AC totally enclosed, non-ventilated , squirrel cage motors with anti-friction bearings re rated 30 minutes, degrees temperature rise above 40 degrees C ambient in accordance with NEMA standards, using Class "F" insulation.
- D. Voltage 208V, 3 phase, 60 Hz
- E. Magnetic AC, Adjustable spring set, magnetic release, flange mounted disc brakes.
- F. Single speed, 70 FPM.

2.5 BRIDGE END TRUCKS AND WHEELS

- A. Trucks are constructed of two structural steel channels welded together with diaphragms, to form a rigid box section.
- B. Steel plate rail sweeps and energy absorbing rubber bumpers.
- C. Wheels tapered tread, double flange, machined alloy steel hardened 375-425 BHN.

2.6 ELECTRICAL

- A. Motors crane and hoist duty, squirrel cage, TENV, Class 'F' insulation.
- B. Controls magnetic reversing starters, magnetic mainline contactor, 110 volt control circuit transformer, manual disconnect. Enclosure NEMA.
- C. Adjustable solid state soft start bridge control.
- D. Bridge electrification shall be provided with flat cable conductors suspended from trolleys operating in a steel track along the crane bridge.
- E. Provide Festooned traveling pendant station suspended from the hoist.

All motions to be VFD controlled.

F. Provide main collectors for three pole insul-8 or equal runway conductor system.

G. Miscellaneous: Paint all bridge structural components safety yellow.

PART 3 - EXECUTION

3.1 COORDINATION

A. Coordinate installation with electrical and structural steel trades prior to submittal of shop drawings prior to fabrication. Make proper adjustments for final fabrication and installation for proper fitting and integration to other building systems.

3.2 MAINTENANCE MANUALS

A. Submit two copies of parts and maintenance manuals to owner.

B. Test: Test full operation of installed equipment. Instruct the facility occupant in the operation of the equipment.

End Section 14460



SECTION 220500 - COMMON WORK RESULTS FOR PLUMBING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Piping materials and installation instructions common to most piping systems.
2. Dielectric fittings.
3. Mechanical sleeve seals.
4. Sleeves.
5. Escutcheons.
6. Grout.
7. Equipment installation requirements common to equipment sections.
8. Supports and anchorages.

1.2 DEFINITIONS

- A. Finished Spaces: Spaces other than plumbing and electrical equipment rooms, furred spaces, pipe chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.
- B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and plumbing equipment rooms.
- C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.
- D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in chases.
- E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

1.3 GENERAL REQUIREMENTS

- A. Carefully examine General Conditions, other specification sections, and other drawings (in addition to DIVISION 22), in order to be fully acquainted with their effect on plumbing work. Additions to the contract cost will not be allowed due to failure to inspect existing conditions.
- B. Do all work in compliance with 2010 Florida Building Code, and the Codes adopted therein, 2010 Florida Fire Prevention Code. Obtain and pay for any and all required permits, inspections, certificates of inspections and approval, and the like, and deliver such certificates to the Architect/Engineer.
- C. Cooperate and coordinate with all other trades. Perform work in such manner and at such times as not to delay work of other trades. Complete all work as soon as the condition of the structure and installations of equipment will permit. Patch, in a satisfactory manner and by the proper craft, any work damaged by plumbing workmen.

- D. Furnish, perform, or otherwise provide all labor (including, but not limited to, all planning, purchasing, transporting, rigging, hoisting, storing, installing, testing, chasing, channeling, cutting, trenching, excavating and backfilling), coordination, field verification, equipment installation, support, and safety, supplies, and materials necessary for the correct installation of complete and functional plumbing systems (as described or implied by these specifications and the applicable drawings).
- E. Any valve, fitting, or fixture coming in contact with potable water must have a weighted average lead content of less than 0.25%.

1.4 DRAWINGS:

- A. Indicate only diagrammatically the extent, general character, and approximate location of work. Where work is indicated, but with minor details omitted, furnish and install it complete and so as to perform its intended functions.
- B. DIVISION 22 work called for under any section of the project specifications, shall be considered as included in this work unless specifically excluded by inclusion in some other branch of the work. This shall include roughing-in for connections and equipment as called for or inferred. This would include cold water, hot water and sanitary connection required for all sinks, hose bibs, grease traps, emergency fixtures, ice machines, etc as required for a functional installation, whether shown on the drawings or not. Check all drawings and specifications for the project and shall be responsible for the installation of all DIVISION 22 work.
- C. Take finish dimensions at the job site in preference to scale dimensions. Do not scale drawings where specific details and dimensions for DIVISION 22 work are not shown on the drawings, take measurements and make layouts as required for the proper installation of the work and coordination with all drawings and coordination with all other work on the project. In case of any discrepancies between the drawings and the specifications that have not been clarified by addendum prior to bidding, it shall be assumed by the signing of the contract that the higher cost (if any difference in costs) is included in the contract price, and perform the work in accordance with the drawings or with the specifications, as determined and approved by the Architect/ Engineer, and no additional costs shall be allowed to the base contract price.
- D. Carefully check the drawings and specifications of all trades and divisions before installing any of the work. Contractor shall in all cases consider the work of all other trades, and shall coordinate his work with them so that the best arrangements of all equipment, piping, conduit, ducts, rough-in, etc., can be obtained. The avoidance of any beams, joist or bracing that is an obstruction to piping, shall be included in the bid. This includes the reroute of piping or dimension revisions required to obtain the intended function of the plumbing work. No cost will be paid by the owner for these modifications that can be identified by reviewing all sets of drawings prior to bid.
- E. Obtain manufacturer's data on all equipment, the dimensions of which may affect plumbing work. Use this data to coordinate proper service connections, entry locations, etc., and to ensure minimum clearances are maintained.

1.5 QUALIFICATIONS OF CONTRACTOR:

- A. Contractor performing any part of this scope of work shall be a Florida State Certified Plumbing Contractor (Type CFC)

- B. Provide field superintendent who has had a minimum of four (4) years previous successful experience on projects of comparable size and complexity. Superintendent shall be on the site at all times during construction.

1.6 SITE VISIT/CONDITIONS

- A. Visit the site of this contract and thoroughly familiarize with all existing field conditions and the proposed work as described or implied by the contract documents. During the course of this site visit, verify every aspect of the proposed work and the existing field conditions in the areas of construction which might affect this work. No compensation or reimbursement for additional expenses incurred due to failure or neglect to make a thorough investigation of the contract documents and the existing site conditions will be permitted.
- B. Install all equipment so that all Code required and Manufacturer required or recommended servicing clearances are maintained. Coordinate the proper arrangement and installation of all equipment within any designated space. If it is determined that a departure from the Contract Documents is necessary, submit to the A/E, for approval, detailed drawings of the proposed changes prior to bid.
- C. Submission of a proposal will be construed as evidence that such examination has been made and later claims for labor, equipment or materials required because of difficulties encountered will not be recognized.
- D. Existing conditions and utilities indicated are taken from existing construction documents, surveys, and field investigations. Unforeseen conditions probably exist and existing conditions shown on drawings may differ from the actual existing installation with the result being that new work may not be field located exactly as shown on the drawings. Field verify dimensions of all site conditions prior to bidding. Notify Owner if deviations are found at least 10 days prior to the bid opening date. Notify A/E if deviations are found.
- E. All existing plumbing is not shown. Become familiar with all existing conditions prior to bidding, and include in the bid the removal of all plumbing fixtures, equipment and piping etc. that is not being reused, back to its originating point.
- F. Locate all existing utilities and protect them from damage. Pay for repair or replacement of utilities or other property damaged by operations in conjunction with the completion of this work.
- G. Work is in connection with existing buildings which must remain in operation while work is being performed. Work shall be in accord with the schedule required by the Contract. Schedule work for a minimum shut down to Owner. Notify Owner 72 hours in advance of any shut-down of existing systems. Perform work during non-operating hours unless otherwise accepted by Owner. Protect existing buildings and equipment during construction.

1.7 SUBMITTALS

- A. Welding certificates.

1.8 QUALITY ASSURANCE

- A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."

- B. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
 - 1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
 - 2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

- C. Electrical Characteristics for Plumbing Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

PART 2 - PRODUCTS

2.1 PIPE, TUBE, AND FITTINGS

- A. Refer to individual Division 22 piping Sections for pipe, tube, and fitting materials and joining methods.

- B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

2.2 JOINING MATERIALS

- A. Refer to individual Division 22 piping Sections for special joining materials not listed below.

- B. Pipe-Flange Gasket Materials: ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch maximum thickness unless thickness or specific material is indicated.

- C. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.

- D. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

- E. Brazing Filler Metals: AWS A5.8, BCuP Series or BAg1, unless otherwise indicated.

- F. Welding Filler Metals: Comply with AWS D10.12.

2.3 DIELECTRIC FITTINGS

- A. Description: Combination fitting of copper alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.

- B. Insulating Material: Suitable for system fluid, pressure, and temperature.

- C. Dielectric Unions: Factory-fabricated, union assembly, for 250-psig minimum working pressure at 180 deg F.

- D. Dielectric Flanges: Factory-fabricated, companion-flange assembly, for 150- or 300-psig minimum working pressure as required to suit system pressures.

- E. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig minimum working pressure at 225 deg F.
- F. Dielectric Nipples: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig minimum working pressure at 225 deg F.

2.4 MECHANICAL SLEEVE SEALS

- A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.
- B. Sealing Elements: EPDM interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
- C. Pressure Plates: Stainless steel. Include two for each sealing element.
- D. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.5 SLEEVES

- A. Galvanized-Steel Sheet: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.
- B. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.
- C. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
- D. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.
 - 1. Underdeck Clamp: Clamping ring with set screws.

2.6 ESCUTCHEONS

- A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.
- B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with polished chrome-plated finish.
- C. One-Piece, Cast-Brass Type: With set screw.
 - 1. Finish: Polished chrome-plated.

2.7 GROUT

- A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.

1. Characteristics: Post-hardening, volume-adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
2. Design Mix: 5000-psi, 28-day compressive strength.
3. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 PIPING SYSTEMS - COMMON REQUIREMENTS

- A. Install piping according to the following requirements and Division 22 Sections specifying piping systems.
- B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- C. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.
- D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- F. Install piping to permit valve servicing.
- G. Install piping at indicated slopes.
- H. Install piping free of sags and bends.
- I. Install fittings for changes in direction and branch connections.
- J. Install piping to allow application of insulation.
- K. Select system components with pressure rating equal to or greater than system operating pressure.
- L. Install escutcheons for penetrations of walls, ceilings, and floors.
- M. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.
- N. Aboveground, Exterior-Wall Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
 1. Install steel pipe for sleeves smaller than 6 inches in diameter.
 2. Install cast-iron "wall pipes" for sleeves 6 inches and larger in diameter.
 3. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten

bolts against pressure plates that cause sealing elements to expand and make watertight seal.

- O. Underground, Exterior-Wall Pipe Penetrations: Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
 - 1. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.
- P. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Refer to Division 07 Section "Penetration Firestopping" for materials.
- Q. Verify final equipment locations for roughing-in.
- R. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.
- S. All plumbing equipment are subject to the requirements of Sustainable Construction Requirements.

3.2 PIPING JOINT CONSTRUCTION

- A. Join pipe and fittings according to the following requirements and Division 22 Sections specifying piping systems.
- B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.
- E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.
- F. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
 - 1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
 - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
- G. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.

- H. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.
- I. Plastic Piping Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
 - 1. Comply with ASTM F 402, for safe-handling practice of cleaners, primers, and solvent cements.
 - 2. PVC Nonpressure Piping: Join according to ASTM D 2855.
 - 3. PVC to ABS Nonpressure Transition Fittings: Join according to ASTM D 3138 Appendix.
- J. Plastic Nonpressure Piping Gasketed Joints: Join according to ASTM D 3212.

3.3 PIPING CONNECTIONS

- A. Make connections according to the following, unless otherwise indicated:
 - 1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
 - 2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.
 - 3. Dry Piping Systems: Install dielectric unions and flanges to connect piping materials of dissimilar metals.
 - 4. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

3.4 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

- A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.
- B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.
- C. Install plumbing equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.
- D. Install equipment to allow right of way for piping installed at required slope.

3.5 CONCRETE BASES

- A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes at Project.
 - 1. Construct concrete bases of dimensions indicated, but not less than 4 inches larger in both directions than supported unit.
 - 2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of the base.
 - 3. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.

4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
5. Install anchor bolts to elevations required for proper attachment to supported equipment.
6. Install anchor bolts according to anchor-bolt manufacturer's written instructions.
7. Use 3000-psi, 28-day compressive-strength concrete and reinforcement as specified in Division 03 Section "Cast-in-Place Concrete."

3.6 ERECTION OF METAL SUPPORTS AND ANCHORAGES

- A. Refer to Division 05 Section "Metal Fabrications" for structural steel.
- B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor plumbing materials and equipment.
- C. Field Welding: Comply with AWS D1.1.

3.7 ERECTION OF WOOD SUPPORTS AND ANCHORAGES

- A. Cut, fit, and place wood grounds, nailers, blocking, and anchorages to support, and anchor plumbing materials and equipment.
- B. Select fastener sizes that will not penetrate members if opposite side will be exposed to view or will receive finish materials. Tighten connections between members. Install fasteners without splitting wood members.
- C. Attach to substrates as required to support applied loads.

3.8 GROUTING

- A. Mix and install grout for plumbing equipment base bearing surfaces, pump and other equipment base plates, and anchors.
- B. Clean surfaces that will come into contact with grout.
- C. Provide forms as required for placement of grout.
- D. Avoid air entrapment during placement of grout.
- E. Place grout, completely filling equipment bases.
- F. Place grout on concrete bases and provide smooth bearing surface for equipment.
- G. Place grout around anchors.
- H. Cure placed grout.

END OF SECTION 220500

SECTION 22 05 23 - GENERAL-DUTY VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Bronze ball valves.
 - 2. Bronze angle valves.
 - 3. Bronze swing check valves.
 - 4. Bronze globe valves.
- B. Related Sections:
 - 1. Division 22 plumbing piping Sections for specialty valves applicable to those Sections only.
 - 2. Division 22 Section "Identification for Plumbing Piping and Equipment" for valve tags and schedules.

1.2 SUBMITTALS

- A. Product Data: For each type of valve indicated.

1.3 QUALITY ASSURANCE

- A. ASME Compliance: ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
- B. NSF Compliance: NSF 61 for valve materials for potable-water service.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR VALVES

- A. Refer to valve schedule articles for applications of valves.
- B. Any valve, fitting, or fixture coming in contact with potable water must have a weighted average lead content of less than 0.25%.
- C. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.
- D. Valve Sizes: Same as upstream piping unless otherwise indicated.
- E. Valves in Insulated Piping: With 2-inch stem extensions and the following features:
 - 1. Ball Valves: With extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation.
- F. Valve-End Connections:
 - 1. Solder Joint: With sockets according to ASME B16.18.

2. Threaded: With threads according to ASME B1.20.1
3. Grooved: With grooves according to AWWA C606.
4. Press Fitting End: With connection according to CSA No. 1-02.

2.2 BRONZE ANGLE VALVES

A. Lead Free, Class 150, Bronze Angle Valves with Nonmetallic Disc:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Crane Co.; Crane Valve Group; Crane Valves.
 - b. Crane Co.; Crane Valve Group; Jenkins Valves.
 - c. Crane Co.; Crane Valve Group; Stockham Division.
 - d. Hammond Valve.
 - e. Milwaukee Valve Company.
 - f. NIBCO INC.
 - g. Powell Valves.
2. Description:
 - a. Standard: MSS SP-80, Type 2.
 - b. CWP Rating: 300 psig (2070 kPa).
 - c. Body Material: ASTM B 62, bronze with integral seat and union-ring bonnet.
 - d. Ends: Threaded.
 - e. Stem: Bronze.
 - f. Disc: PTFE or TFE.
 - g. Packing: Asbestos free.
 - h. Handwheel: Bronze.

2.3 BRONZE BALL VALVES

A. Lead Free, Two-Piece, Full-Port, Bronze Ball Valves with Stainless Steel Trim:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Conbraco Industries, Inc.; Apollo Valves.
 - b. Crane Co.; Crane Valve Group; Crane Valves.
 - c. Hammond Valve.
 - d. Legend Valve.
 - e. Milwaukee Valve Company.
 - f. NIBCO INC.
 - g. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
2. Description:
 - a. Standard: MSS SP-110.
 - b. SWP Rating: 150 psig.
 - c. CWP Rating: 600 psig.
 - d. Body Design: Two piece.
 - e. Body Material: Bronze.
 - f. Ends: Grooved or Press Fitting.
 - g. Seats: PTFE or TFE or RPTFE.
 - h. Stem: Bronze.
 - i. Ball: Chrome-plated brass.
 - j. Port: Full.

2.4 BRONZE SWING CHECK VALVES

- A. Lead Free, Class 125, Bronze Swing Check Valves with Bronze Disc:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Crane Co.; Crane Valve Group; Crane Valves.
 - b. Crane Co.; Crane Valve Group; Stockham Division.
 - c. Hammond Valve.
 - d. Milwaukee Valve Company.
 - e. Nibco Inc.
 - f. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
 - 2. Description:
 - a. Standard: MSS SP-80, Type 3.
 - b. CWP Rating: 200 psig.
 - c. Body Design: Horizontal flow.
 - d. Body Material: ASTM B 62, bronze.
 - e. Ends: Press Fitting.
 - f. Disc: Bronze.

PART 3 - EXECUTION

3.1 VALVE INSTALLATION

- A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.
- B. All shutoff valves installed on domestic water piping in building interiors for pipe sizes less than 3" shall be full flow ball valves for pipe. The use of gate valves is prohibited.
- C. Locate valves for reasonable access and provide separate support where necessary.
- D. Install valves in horizontal piping with stem at or above center of pipe.
- E. Install valves in position to allow full stem movement.

3.2 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

- A. If valve applications are not indicated, use the following:
 - 1. Shutoff Service: Ball or butterfly.
 - 2. Throttling Service: Ball valves and butterfly valves.
 - 3. Pump-Discharge Check Valves:
 - a. NPS 2 and Smaller: Bronze swing check valves with bronze disc.
 - b. NPS 2-1/2 and Larger for Domestic Water: Iron swing check valves with lever and weight or with spring.
- B. If valves with specified SWP classes or CWP ratings are not available, the same types of valves with higher SWP class or CWP ratings may be substituted.
- C. Select valves, except wafer types, with the following end connections:
 - 1. For Copper Tubing, NPS 2 and Smaller: Threaded or press fitting ends except where solder-joint valve-end option is indicated in valve schedules below.
 - 2. For Copper Tubing, NPS 2-1/2 to NPS 4: Flanged or grooved ends except where threaded valve-end option is indicated in valve schedules below.
 - 3. For Copper Tubing, NPS 5 and Larger: Flanged or grooved ends.

4. For Steel Piping, NPS 2 and Smaller: Threaded or press fitting ends.
5. For Steel Piping, NPS 2-1/2 to NPS 4: Flanged or grooved ends except where threaded valve-end option is indicated in valve schedules below.
6. For Steel Piping, NPS 5 and Larger: Flanged or grooved ends.

3.3 DOMESTIC, HOT- AND COLD-WATER VALVE SCHEDULE

- A. Pipe NPS 2 and Smaller:
 1. Bronze and Brass Valves: May be provided with solder-joint ends instead of threaded ends.
 2. Bronze Angle Valves: Class 125, bronze disc.
 3. Ball Valves: Two piece, full port, brass or bronze with brass bronze trim.
 4. Bronze Swing Check Valves: Class 125, bronze disc.
 5. Bronze Globe Valves: Class 125, bronze disc.
- B. Pipe NPS 2-1/2 and Larger:
 1. Iron Valves, NPS 2-1/2 and Larger : May be provided with grooved or flanged ends.
 2. Iron, Single-Flange Butterfly Valves: 200 CWP, EPDM NBR seat.
 3. Iron Swing Check Valves: Class 125, metal seats.
 4. Iron Swing Check Valves with Closure Control: Class 125, lever and weight.
 5. Iron Globe Valves: Class 125.

END OF SECTION 22 05 23

SECTION 22 05 29 - HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Steel pipe hangers and supports.
 - 2. Trapeze pipe hangers.
 - 3. Fastener systems.
 - 4. Equipment supports.
- B. See Division 05 Section "Metal Fabrications" for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.
- C. See Division 22 Section "Expansion Fittings and Loops for Plumbing Piping" for pipe guides and anchors.

1.2 DEFINITIONS

- A. Terminology: As defined in MSS SP-90, "Guidelines on Terminology for Pipe Hangers and Supports."

1.3 PERFORMANCE REQUIREMENTS

- A. Design supports for multiple pipes capable of supporting combined weight of supported systems, system contents, and test water.
- B. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

1.4 SUBMITTALS

- A. Product Data: For the following:
 - 1. Steel pipe hangers and supports.
 - 2. Powder-actuated fastener systems.
- B. Shop Drawings: Show fabrication and installation details and include calculations for the following:
 - 1. Trapeze pipe hangers. Include Product Data for components.
 - 2. Equipment supports.
- C. Welding certificates.

1.5 QUALITY ASSURANCE

- A. Welding: Qualify procedures and personnel according to ASME Boiler and Pressure Vessel Code: Section IX.

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. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.
 - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 STEEL PIPE HANGERS AND SUPPORTS

- A. Description: MSS SP-58, Types 1 through 58, factory-fabricated components. Refer to Part 3 "Hanger and Support Applications" Article for where to use specific hanger and support types.
- B. Manufacturers:
 - 1. AAA Technology & Specialties Co., Inc.
 - 2. B-Line Systems, Inc.; a division of Cooper Industries.
 - 3. Globe Pipe Hanger Products, Inc.
 - 4. Grinnell Corp.
 - 5. National Pipe Hanger Corporation.
 - 6. Tolco Inc.
- C. Galvanized, Metallic Coatings: Pregalvanized or hot dipped.
- D. Nonmetallic Coatings: Plastic coating, jacket, or liner.
- E. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion for support of bearing surface of piping.

2.3 TRAPEZE PIPE HANGERS

- A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural-steel shapes with MSS SP-58 hanger rods, nuts, saddles, and U-bolts.

2.4 FASTENER SYSTEMS

- A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

1. Manufacturers:
 - a. Hilti, Inc.
 - b. ITW Ramset/Red Head.
 - c. Masterset Fastening Systems, Inc.
 - d. MKT Fastening, LLC.
 - e. Powers Fasteners.

B. Mechanical-Expansion Anchors: Insert-wedge-type zinc-coated steel, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

1. Manufacturers:
 - a. B-Line Systems, Inc.; a division of Cooper Industries.
 - b. Empire Industries, Inc.
 - c. Hilti, Inc.
 - d. ITW Ramset/Red Head.
 - e. MKT Fastening, LLC.
 - f. Powers Fasteners.

2.5 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural-steel shapes.

2.6 MISCELLANEOUS MATERIALS

A. Structural Steel: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.

1. Properties: Nonstaining, noncorrosive, and nongaseous.
2. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT APPLICATIONS

- A. Specific hanger and support requirements are specified in Sections specifying piping systems and equipment.
- B. Comply with MSS SP-69 for pipe hanger selections and applications that are not specified in piping system Sections.
- C. Use hangers and supports with galvanized, metallic coatings for piping and equipment that will not have field-applied finish.
- D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

- E. Use padded hangers for piping that is subject to scratching.
- F. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 30.
 - 2. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes, NPS 3/4 to NPS 24, requiring clamp flexibility and up to 4 inches of insulation.
 - 3. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 8.
 - 4. U-Bolts (MSS Type 24): For support of heavy pipes, NPS 1/2 to NPS 30.
- G. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers, NPS 3/4 to NPS 20.
 - 2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers, NPS 3/4 to NPS 20, if longer ends are required for riser clamps.
- H. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
 - 2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
- I. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
 - 2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joint construction to attach to top flange of structural shape.
 - 3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
 - 4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
 - 5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
 - 6. C-Clamps (MSS Type 23): For structural shapes.
 - 7. Welded-Steel Brackets: For support of pipes from below, or for suspending from above by using clip and rod. Use one of the following for indicated loads:
 - a. Light (MSS Type 31): 750 lb.
 - b. Medium (MSS Type 32): 1500 lb.
 - c. Heavy (MSS Type 33): 3000 lb.
 - 8. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
 - 9. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
- J. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
 2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
- K. Comply with MSS SP-69 for trapeze pipe hanger selections and applications that are not specified in piping system Sections.
- L. Comply with MFMA-102 for metal framing system selections and applications that are not specified in piping system Sections.
- M. Use powder-actuated fasteners instead of building attachments where required in concrete construction.

3.2 HANGER AND SUPPORT INSTALLATION

- A. Steel Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.
- B. Trapeze Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping and support together on field-fabricated trapeze pipe hangers.
1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified above for individual pipe hangers.
 2. Field fabricate from ASTM A 36/A 36M, steel shapes selected for loads being supported. Weld steel according to AWS D1.1.
- C. Fastener System Installation:
1. Install powder-actuated fasteners in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
 2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.
- D. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.
- E. Equipment Support Installation: Fabricate from welded-structural-steel shapes.
- F. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.
- G. Install lateral bracing with pipe hangers and supports to prevent swaying.
- H. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

- I. Load Distribution: Install hangers and supports so piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- J. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by ASME B31.9 (for building services piping) are not exceeded.

3.3 EQUIPMENT SUPPORTS

- A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.
- B. Grouting: Place grout under supports for equipment and make smooth bearing surface.
- C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.4 METAL FABRICATIONS

- A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.
- B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.
- C. Field Welding: Comply with AWS D1.1 procedures for shielded metal arc welding, appearance and quality of welds, and methods used in correcting welding work, and with the following:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. Finish welds at exposed connections so no roughness shows after finishing and contours of welded surfaces match adjacent contours.

3.5 ADJUSTING

- A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

3.6 PAINTING

- A. Touch Up: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
 - 1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.
- B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 22 05 29

SECTION 22 05 53 - IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Equipment labels.
 - 2. Warning signs and labels.
 - 3. Pipe labels.
 - 4. Stencils.
 - 5. Valve tags.
 - 6. Warning tags.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples: For color, letter style, and graphic representation required for each identification material and device.
- C. Equipment Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.
- D. Valve numbering scheme.
- E. Valve Schedules: For each piping system to include in maintenance manuals.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

- A. Metal Labels for Equipment:
 - 1. Material and Thickness: Brass, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
 - 2. Letter Color: White.
 - 3. Background Color: Black.
 - 4. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
 - 5. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for

greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.

6. Fasteners: Stainless-steel rivets or self-tapping screws.
7. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

- B. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), and the Specification Section number and title where equipment is specified.
- C. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch bond paper. Tabulate equipment identification number, and identify Drawing numbers where equipment is indicated (plans, details, and schedules) and the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.2 PIPE LABELS

- A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.
- B. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.
- C. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings; also include pipe size and an arrow indicating flow direction.
 1. Flow-Direction Arrows: Integral with piping-system service lettering to accommodate both directions or as separate unit on each pipe label to indicate flow direction.
 2. Lettering Size: Size letters according to ASME A13.1 for piping.

2.3 VALVE TAGS

- A. Valve Tags: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch numbers.
 1. Tag Material: Brass, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
 2. Fasteners: Brass wire-link chain or beaded chain or S-hook.
- B. Valve Schedules: For each piping system, on 8-1/2-by-11-inch bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.
 1. Valve-tag schedule shall be included in operation and maintenance data.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.2 GENERAL INSTALLATION REQUIREMENTS

- A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
- B. Coordinate installation of identifying devices with locations of access panels and doors.
- C. Install identifying devices before installing acoustical ceilings and similar concealment.

3.3 EQUIPMENT LABEL INSTALLATION

- A. Install or permanently fasten labels on each major item of mechanical equipment.
- B. Locate equipment labels where accessible and visible.

3.4 PIPE LABEL INSTALLATION

- A. Piping Color Coding: Painting of piping is specified in Section 099123 "Interior Painting."
- B. Pipe Label Locations: Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:
 - 1. Near each valve and control device.
 - 2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
 - 3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
 - 4. At access doors, manholes, and similar access points that permit view of concealed piping.
 - 5. Near major equipment items and other points of origination and termination.
 - 6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
 - 7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.
- C. Directional Flow Arrows: Arrows shall be used to indicate direction of flow in pipes, including pipes where flow is allowed in both directions.
- D. Pipe Label Color Schedule:
 - 1. Low-Pressure Compressed Air Piping:
 - a. Background: Safety blue.
 - b. Letter Colors: White.

2. High-Pressure Compressed Air Piping:

- a. Background: Safety blue.
- b. Letter Colors: White.

3. Domestic Water Piping

- a. Background: Safety green.
- b. Letter Colors: White.

4. Sanitary Waste Drainage Piping:

- a. Background Color: Safety black.
- b. Letter Color: White.

3.5 VALVE-TAG INSTALLATION

A. Install tags on valves and control devices in piping systems, except check valves, valves within factory-fabricated equipment units, shutoff valves, faucets, convenience and lawn-watering hose connections, and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.

B. Valve-Tag Application Schedule: Tag valves according to size, shape, and color scheme and with captions similar to those indicated in the following subparagraphs:

1. Valve-Tag Size and Shape:

- a. Cold Water: 1-1/2 inches, round.
- b. Low-Pressure Compressed Air: 1-1/2 inches, round.

2. Valve-Tag Colors:

- a. Cold Water: Natural.
- b. Low-Pressure Compressed Air: Natural.

3. Letter Colors:

- a. Cold Water: White.
- b. Low-Pressure Compressed Air: White.

3.6 WARNING-TAG INSTALLATION

A. Write required message on, and attach warning tags to, equipment and other items where required.

END OF SECTION 22 05 53

SECTION 22 11 16 - DOMESTIC WATER PIPING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Under-building slab and aboveground domestic water pipes, tubes, fittings, and specialties inside the building.
 - 2. Specialty valves.
 - 3. Flexible connectors.
 - 4. Escutcheons.
 - 5. Sleeves and sleeve seals.
- B. Related Section: Division 22 Section "Facility Water Distribution Piping" for water-service piping and water meters outside the building from source to the point where water-service piping enters the building.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Field quality-control reports.

1.3 QUALITY ASSURANCE

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- B. Comply with NSF 61 for potable domestic water piping and components.

1.4 FIELD CONDITIONS

- A. Interruption of Existing Water Service: Do not interrupt water service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary water service according to requirements indicated:
 - 1. Notify Owner no fewer than 5 days in advance of proposed interruption of water service.
 - 2. Do not interrupt water service without Owner's written permission.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

- A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.
- B. Potable-water piping and components shall comply with NSF 14 and NSF 61.

- C. Any valve, fitting, or fixture coming in contact with potable water must have a weighted average lead content of less than 0.25%.

2.2 COPPER TUBE AND FITTINGS

- A. Hard Copper Tube: ASTM B 88, Type K.
- B. Manufacturers: Subject to compliance with requirements, provide piping products and fittings by one of the following:
 - 1. Mueller Industries
 - 2. Wieland Copper Products LLC
 - 3. Cerro Flow Products LLC
- C. Fittings:
 - 1. Cast-Copper Solder-Joint Fittings: ASME B16.18, pressure fittings.
 - 2. Wrought-Copper Solder-Joint Fittings: ASME B16.22, wrought-copper pressure fittings.
 - 3. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends.
 - 4. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body, with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.
 - 5. Copper Pressure-Seal-Joint Fittings:
 - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) NIBCO INC.
 - 2) Viega; Plumbing and Heating Systems.
 - b. NPS 2 and Smaller: Wrought-copper fitting with EPDM-rubber O-ring seal in each end.
 - c. NPS 2-1/2 to NPS 4: Cast-bronze or wrought-copper fitting with EPDM-rubber O-ring seal in each end.

2.3 STAINLESS-STEEL PIPING

- A. Potable-water piping and components shall comply with NSF 61.
- B. Stainless-Steel Pipe: ASTM A 312/A 312M, Schedule 10 and Schedule 40.
- C. Stainless-Steel Pipe Fittings: ASTM A 815/A 815M.
- D. Manufacturers: Subject to compliance with requirements, provide piping products and fittings by one of the following:
 - 1. Felker Brothers
 - 2. Plymouth Tube Co.
 - 3. American Stainless & Supply
- E. Appurtenances for Grooved-End, Stainless-Steel Pipe:
 - 1. Fittings for Grooved-End, Stainless-Steel Pipe: Stainless-steel casting with dimensions matching stainless-steel pipe.
 - 2. Mechanical Couplings for Grooved-End, Stainless-Steel Pipe:
 - a. AWWA C606 for stainless-steel-pipe dimensions.
 - b. Stainless-steel housing sections.
 - c. Stainless-steel bolts and nuts.
 - d. EPDM-rubber gaskets suitable for hot and cold water.
 - e. Minimum Pressure Rating:
 - 1) NPS 8 and Smaller: 600 psig.

2.4 PIPING JOINING MATERIALS

- A. Pipe-Flange Gasket Materials: AWWA C110, rubber, flat face, 1/8 inch thick or ASME B16.21, nonmetallic and asbestos free, unless otherwise indicated; full-face or ring type unless otherwise indicated.
- B. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.
- C. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys for general-duty brazing unless otherwise indicated.
- D. Joint connections for joining domestic water pipe shall be lead free. When used, 95/5 solder and flux shall not have a lead content exceeding 0.2%. Threaded connections shall be made with non-lead bearing compounds.

2.5 SPECIALTY VALVES

- A. Comply with requirements in Division 22 Section "General-Duty Valves for Plumbing Piping" for general-duty metal valves.
- B. Comply with requirements in Division 22 Section "Domestic Water Piping Specialties" for balancing valves, drain valves, backflow preventers, and vacuum breakers.

2.6 DIELECTRIC FITTINGS

- A. General Requirements: Assembly of copper alloy and ferrous materials or ferrous material body with separating nonconductive insulating material suitable for system fluid, pressure, and temperature.
- B. Dielectric Unions:
 - 1. Description:
 - a. Standard: ASSE 1079.
 - b. Pressure Rating: 150 psig at 180 deg F.
 - c. End Connections: Solder-joint copper alloy and threaded ferrous.
- C. Dielectric Flanges:
 - 1. Description:
 - a. Standard: ASSE 1079.
 - b. Factory-fabricated, bolted, companion-flange assembly.
 - c. Pressure Rating: 150 psig.
 - d. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.
- D. Dielectric-Flange Kits:
 - 1. Description:
 - a. Nonconducting materials for field assembly of companion flanges.
 - b. Pressure Rating: 150 psig.
 - c. Gasket: Neoprene or phenolic.
 - d. Bolt Sleeves: Phenolic or polyethylene.
 - e. Washers: Phenolic with steel backing washers.
- E. Dielectric Couplings:
 - 1. Description:
 - a. Galvanized-steel coupling.
 - b. Pressure Rating: 300 psig at 225 deg F.
 - c. End Connections: Female threaded.

- d. Lining: Inert and noncorrosive, thermoplastic.

F. Dielectric Nipples:

- 1. Description:
 - a. Standard: IAPMO PS 66.
 - b. Electroplated steel nipple complying with ASTM F 1545.
 - c. Pressure Rating: 300 psig at 225 deg F.
 - d. End Connections: Male threaded or grooved.
 - e. Lining: Inert and noncorrosive, propylene.

2.7 FLEXIBLE CONNECTORS

- A. Stainless-Steel-Hose Flexible Connectors: Corrugated-stainless-steel tubing with stainless-steel wire-braid covering and ends welded to inner tubing.
 - 1. Working-Pressure Rating: Minimum 200 psig.
 - 2. End Connections NPS 2 and Smaller: Threaded steel-pipe nipple.
 - 3. End Connections NPS 2-1/2 and Larger: Flanged steel nipple.

2.8 ESCUTCHEONS

- A. General: Manufactured ceiling, floor, and wall escutcheons and floor plates.
- B. One Piece, Cast Brass: Polished, chrome-plated finish with setscrews.
- C. One Piece, Deep Pattern: Deep-drawn, box-shaped brass with chrome-plated finish.
- D. One Piece, Stamped Steel: Chrome-plated finish with setscrew.
- E. One-Piece Floor Plates: Cast-iron flange with holes for fasteners.

2.9 SLEEVES

- A. Cast-Iron Wall Pipes: Fabricated of cast iron, and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.
- B. Galvanized-Steel-Sheet Sleeves: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.
- C. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc-coated, with plain ends.
- D. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.
 - 1. Underdeck Clamp: Clamping ring with setscrews.

2.10 SLEEVE SEALS

- A. Description: Modular sealing element unit, designed for field assembly, used to fill annular space between pipe and sleeve.
 - 1. Sealing Elements: EPDM-rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
 - 2. Pressure Plates: Stainless steel.

3. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements.

2.11 GROUT

- A. Standard: ASTM C 1107, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
- B. Characteristics: Nonshrink; recommended for interior and exterior applications.
- C. Design Mix: 5000-psi, 28-day compressive strength.
- D. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 PIPING INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of domestic water piping. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- B. Install copper tubing under building slab according to CDA's "Copper Tube Handbook."
- C. Install ductile-iron piping under building slab with restrained joints according to AWWA C600 and AWWA M41.
- D. Install shutoff valve, hose-end drain valve, strainer, pressure gage, and test tee with valve, inside the building at each domestic water service entrance. Comply with requirements in Division 22 Section "Meters and Gages for Plumbing Piping" for pressure gages and Division 22 Section "Domestic Water Piping Specialties" for drain valves and strainers.
- E. Install shutoff valve immediately upstream of each dielectric fitting.
- F. Install water-pressure-reducing valves downstream from shutoff valves. Comply with requirements in Division 22 Section "Domestic Water Piping Specialties" for pressure-reducing valves.
- G. Install domestic water piping level without pitch and plumb.
- H. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.
- I. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- J. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.
- K. Install piping adjacent to equipment and specialties to allow service and maintenance.
- L. Install piping to permit valve servicing.

- M. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than system pressure rating used in applications below unless otherwise indicated.
- N. Install piping free of sags and bends.
- O. Install fittings for changes in direction and branch connections.
- P. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.
- Q. Install thermostats in hot-water circulation piping
- R. Install sleeves for piping penetrations of walls and floors.
- S. Install sleeve seals for piping penetrations of concrete walls and slabs.
- T. Install escutcheons for piping penetrations of walls and floors.

3.2 JOINT CONSTRUCTION

- A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- B. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.
- C. Brazed Joints: Join copper tube and fittings according to CDA's "Copper Tube Handbook," "Braze Joints" Chapter.
- D. Soldered Joints: Apply ASTM B 813, water-flushable flux to end of tube. Join copper tube and fittings according to ASTM B 828 or CDA's "Copper Tube Handbook."
- E. Pressure-Sealed Joints: Join copper tube and pressure-seal fittings with tools recommended by fitting manufacturer.
- F. Joint Construction for Grooved-End Copper Tubing: Make joints according to AWWA C606. Roll groove ends of tubes. Lubricate and install gasket over ends of tubes or tube and fitting. Install coupling housing sections over gasket with keys seated in tubing grooves. Install and tighten housing bolts.
- G. Joint Construction for Grooved-End Steel Piping: Make joints according to AWWA C606. Roll groove ends of pipe as specified. Lubricate and install gasket over ends of pipes or pipe and fitting. Install coupling housing sections over gasket with keys seated in piping grooves. Install and tighten housing bolts.
- H. Flanged Joints: Select appropriate asbestos-free, nonmetallic gasket material in size, type, and thickness suitable for domestic water service. Join flanges with gasket and bolts according to ASME B31.9.
- I. Dissimilar-Material Piping Joints: Make joints using adapters compatible with materials of both piping systems.

3.3 VALVE INSTALLATION

- A. General-Duty Valves: Comply with requirements in Division 22 Section "General-Duty Valves for Plumbing Piping" for valve installations.

- B. Install shutoff valve close to water main on each branch and riser serving plumbing fixtures or equipment, on each water supply to equipment, and on each water supply to plumbing fixtures that do not have supply stops. Use full port ball valves for piping NPS 4 and smaller.
- C. Install drain valves for equipment at base of each water riser, at low points in horizontal piping, and where required to drain water piping. Drain valves are specified in Division 22 Section "Domestic Water Piping Specialties."
 - 1. Hose-End Drain Valves: At low points in water mains, risers, and branches.
 - 2. Stop-and-Waste Drain Valves: Instead of hose-end drain valves where indicated.
- D. Install balancing valve in each hot-water circulation return branch and discharge side of each pump and circulator. Set balancing valves partly open to restrict but not stop flow. Use ball valves for piping NPS 2 and smaller and butterfly valves for piping NPS 2-1/2 and larger. Comply with requirements in Division 22 Section "Domestic Water Piping Specialties" for balancing valves.

3.4 TRANSITION FITTING INSTALLATION

- A. Install transition couplings at joints of dissimilar piping.
- B. Transition Fittings in Underground Domestic Water Piping:
 - 1. NPS 1-1/2 and Smaller: Fitting-type coupling.
 - 2. NPS 2 and Larger: Sleeve-type coupling.

3.5 DIELECTRIC FITTING INSTALLATION

- A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.
- B. Dielectric Fittings for NPS 2] and Smaller: Use dielectric couplings.
- C. Dielectric Fittings for NPS 2-1/2 to NPS 4: Use dielectric flanges.
- D. Dielectric Fittings for NPS 5 to NPS 6: Use dielectric flange kits.

3.6 FLEXIBLE CONNECTOR INSTALLATION

- A. Install flexible connectors in suction and discharge piping connections to each domestic water pump and in suction and discharge manifold connections to each domestic water booster pump.
- B. Install stainless-steel-hose flexible connectors in steel domestic water piping.

3.7 HANGER AND SUPPORT INSTALLATION

- A. Comply with requirements in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment" for pipe hanger and support products and installation.
 - 1. Vertical Piping: MSS Type 8 or 42, clamps.
 - 2. Individual, Straight, Horizontal Piping Runs:
 - a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
 - b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
 - 3. Base of Vertical Piping: MSS Type 52, spring hangers.
- B. Support vertical piping and tubing at base and at each floor.

- C. Rod diameter may be reduced one size for double-rod hangers, to a minimum of 3/8 inch.
- D. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:
 - 1. NPS 3/4 and Smaller: 60 inches with 3/8-inch rod.
 - 2. NPS 1 and NPS 1-1/4: 72 inches with 3/8-inch rod.
 - 3. NPS 1-1/2 and NPS 2: 96 inches with 3/8-inch rod.
 - 4. NPS 2-1/2: 108 inches with 1/2-inch rod.
 - 5. NPS 3 to NPS 5: 10 feet with 1/2-inch rod.
 - 6. NPS 6: 10 feet with 5/8-inch rod.
- E. Install supports for vertical copper tubing every 10 feet.
- F. Support piping and tubing not listed in this article according to MSS SP-69 and manufacturer's written instructions.

3.8 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to equipment and machines to allow service and maintenance.
- C. Connect domestic water piping to exterior water-service piping. Use transition fitting to join dissimilar piping materials.
- D. Connect domestic water piping to water-service piping with shutoff valve; extend and connect to the following:
 - 1. Domestic Water Booster Pumps: Cold-water suction and discharge piping.
 - 2. Water Heaters: Cold-water inlet and hot-water outlet piping in sizes indicated, but not smaller than sizes of water heater connections.
 - 3. Plumbing Fixtures: Cold- and hot-water supply piping in sizes indicated, but not smaller than required by plumbing code. Comply with requirements in Division 22 plumbing fixture Sections for connection sizes.
 - 4. Equipment: Cold- and hot-water supply piping as indicated, but not smaller than equipment connections. Provide shutoff valve and union for each connection. Use flanges instead of unions for NPS 2-1/2 and larger.

3.9 ESCUTCHEON INSTALLATION

- A. Install escutcheons for penetrations of walls, ceilings, and floors.
- B. Escutcheons for New Piping:
 - 1. Piping with Fitting or Sleeve Protruding from Wall: One piece, deep pattern.
 - 2. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One piece, cast brass with polished chrome-plated finish.
 - 3. Bare Piping at Ceiling Penetrations in Finished Spaces: One piece, cast brass with polished chrome-plated finish.
 - 4. Bare Piping in Unfinished Service Spaces: One piece, cast brass with polished chrome-plated finish.
 - 5. Bare Piping in Equipment Rooms: One piece, cast brass.
 - 6. Bare Piping at Floor Penetrations in Equipment Rooms: One-piece floor plate.

3.10 SLEEVE INSTALLATION

- A. General Requirements: Install sleeves for pipes and tubes passing through penetrations in floors, partitions, roofs, and walls.
- B. Sleeves are not required for core-drilled holes.
- C. Cut sleeves to length for mounting flush with both surfaces unless otherwise indicated.
- D. Install sleeves in slabs and exterior walls as they are built.
- E. For interior wall penetrations, seal annular space between sleeve and pipe or pipe insulation using joint sealants appropriate for size, depth, and location of joint. Comply with requirements in Division 07 Section "Joint Sealants" for joint sealants.
- F. For exterior wall penetrations above grade, seal annular space between sleeve and pipe using joint sealants appropriate for size, depth, and location of joint. Comply with requirements in Division 07 Section "Joint Sealants" for joint sealants.
- G. For exterior wall penetrations below grade, seal annular space between sleeve and pipe using sleeve seals specified in this Section.
- H. Seal space outside of sleeves in concrete slabs and walls with grout.
- I. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation unless otherwise indicated.
- J. Install sleeve materials according to the following applications:
 - 1. Sleeves for Piping Passing through Concrete Floor Slabs: Steel pipe.
 - 2. Sleeves for Piping Passing through Concrete Floor Slabs of Mechanical Equipment Areas or Other Wet Areas: Steel pipe.
 - a. Extend sleeves 2 inches above finished floor level.
 - b. For pipes penetrating floors with membrane waterproofing, extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2 inches above finished floor level. Comply with requirements in Division 07 Section "Sheet Metal Flashing and Trim" for flashing.
 - 3. Sleeves for Piping Passing through Concrete Roof Slabs: Steel pipe.
 - 4. Sleeves for Piping Passing through Exterior Concrete Walls:
 - a. Steel pipe sleeves for pipes smaller than NPS 6.
 - b. Cast-iron wall pipe sleeves for pipes NPS 6 and larger.
 - c. Install sleeves that are large enough to provide 1-inch annular clear space between sleeve and pipe or pipe insulation when sleeve seals are used.
- K. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements in Division 07 Section "Penetration Firestopping" for firestop materials and installations.

3.11 SLEEVE SEAL INSTALLATION

- A. Install sleeve seals in sleeves in exterior concrete walls at water-service piping entries into building.
- B. Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble sleeve seal components and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.12 IDENTIFICATION

- A. Identify system components. Comply with requirements in Division 22 Section "Identification for Plumbing Piping and Equipment" for identification materials and installation.
- B. Label pressure piping with system operating pressure.

3.13 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:

- 1. Piping Inspections:

- a. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
- b. During installation, notify authorities having jurisdiction at least one day before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:
 - 1) Roughing-in Inspection: Arrange for inspection of piping before concealing or closing in after roughing in and before setting fixtures.
 - 2) Final Inspection: Arrange for authorities having jurisdiction to observe tests specified in "Piping Tests" Subparagraph below and to ensure compliance with requirements.
- c. Reinspection: If authorities having jurisdiction find that piping will not pass tests or inspections, make required corrections and arrange for reinspection.
- d. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

- 2. Piping Tests:

- a. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
- b. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit a separate report for each test, complete with diagram of portion of piping tested.
- c. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.
- d. Cap and subject piping to static water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow it to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
- e. Repair leaks and defects with new materials, and retest piping or portion thereof until satisfactory results are obtained.
- f. Prepare reports for tests and for corrective action required.

- B. Domestic water piping will be considered defective if it does not pass tests and inspections.
- C. Prepare test and inspection reports.

3.14 ADJUSTING

- A. Perform the following adjustments before operation:
 - 1. Close drain valves, hydrants, and hose bibbs.

2. Open shutoff valves to fully open position.
3. Open throttling valves to proper setting.
4. Adjust balancing valves in hot-water-circulation return piping to provide adequate flow.
 - a. Manually adjust ball-type balancing valves in hot-water-circulation return piping to provide hot-water flow in each branch.
 - b. Adjust calibrated balancing valves to flows indicated.
5. Remove plugs used during testing of piping and for temporary sealing of piping during installation.
6. Remove and clean strainer screens. Close drain valves and replace drain plugs.
7. Remove filter cartridges from housings and verify that cartridges are as specified for application where used and are clean and ready for use.
8. Check plumbing specialties and verify proper settings, adjustments, and operation.

3.15 CLEANING

A. Clean and disinfect potable domestic water piping as follows:

1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction; if methods are not prescribed, use procedures described in either AWWA C651 or AWWA C652 or follow procedures described below:
 - a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
 - b. Fill and isolate system according to either of the following:
 - 1) Fill system or part thereof with water/chlorine solution with at least 50 ppm of chlorine. Isolate with valves and allow to stand for 24 hours.
 - 2) Fill system or part thereof with water/chlorine solution with at least 200 ppm of chlorine. Isolate and allow to stand for three hours.
 - c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.
 - d. Repeat procedures if biological examination shows contamination.
 - e. Submit water samples in sterile bottles to authorities having jurisdiction.

B. Clean non-potable domestic water piping as follows:

1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
2. Use purging procedures prescribed by authorities having jurisdiction or; if methods are not prescribed, follow procedures described below:
 - a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
 - b. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedures if biological examination shows contamination.

C. Prepare and submit reports of purging and disinfecting activities. Include copies of water-sample approvals from authorities having jurisdiction.

D. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

3.16 PIPING SCHEDULE

- A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.

- B. Flanges and unions may be used for aboveground piping joints unless otherwise indicated.

- C. Aboveground domestic water piping, NPS 2 and smaller, shall be one of the following:
 - 1. Hard copper tube, ASTM B 88, Type K; cast copper solder-joint fittings; and brazed joints.
 - 2. Hard copper tube, ASTM B 88, Type K; copper pressure-seal-joint fittings; and pressure-sealed joints.

- D. Aboveground domestic water piping, NPS 2-1/2 to NPS 4, shall be one of the following:
 - 1. Hard copper tube, ASTM B 88, Type K; cast copper solder-joint fittings; and brazed joints.
 - 2. Hard copper tube, ASTM B 88, Type K; copper pressure-seal-joint fittings; and pressure-sealed joints.
 - 3. Stainless-steel Schedule 10 pipe, grooved-joint fittings, and grooved joints.

- E. Aboveground compressed air piping, shall be one of the following:
 - 1. Stainless-steel Schedule 10 pipe, grooved-joint fittings, and grooved joints.

3.17 VALVE SCHEDULE

- A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:
 - 1. Shutoff Duty: Use full port ball valves for piping NPS 4 and smaller.
 - 2. Throttling Duty: Use globe valves for piping NPS 2 and smaller.
 - 3. Hot-Water Circulation Piping, Balancing Duty: Calibrated balancing valves.
 - 4. Drain Duty: Hose-end drain valves.

- B. Use check valves to maintain correct direction of domestic water flow to and from equipment.

END OF SECTION 22 11 16

SECTION 221119 - DOMESTIC WATER PIPING SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following domestic water piping specialties:
 - 1. Vacuum breakers.
 - 2. Balancing valves.
 - 3. Temperature-actuated water mixing valves.
 - 4. Hose bibbs.
 - 5. Wall hydrants.
 - 6. Drain valves.
 - 7. Water hammer arresters.
 - 8. Trap-seal primer valves.
- B. See Division 22 Section "Domestic Water Piping" for water meters.
- C. See Division 22 Section "Drinking Fountains and Water Coolers" for water filters for water coolers.

1.2 PERFORMANCE REQUIREMENTS

- A. Minimum Working Pressure for Domestic Water Piping Specialties: 125 psig, unless otherwise indicated.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Field quality-control test reports.
- C. Operation and maintenance data.

1.4 QUALITY ASSURANCE

- A. NSF Compliance:
 - 1. Comply with NSF 14, "Plastics Piping Components and Related Materials," for plastic domestic water piping components.
 - 2. Comply with NSF 61, "Drinking Water System Components - Health Effects; Sections 1 through 9."

PART 2 - PRODUCTS

2.1 PRODUCT PERFORMANCE

- A. General: Any valve, fitting, or fixture coming in contact with potable water must have a weighted average lead content of less than 0.25%.

2.2 VACUUM BREAKERS

- A. Pipe-Applied, Atmospheric-Type Vacuum Breakers:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Conbraco Industries, Inc.
 - b. FEBCO; SPX Valves & Controls.
 - c. Watts Industries, Inc.; Water Products Div.
 - d. Zurn Plumbing Products Group; Wilkins Div.
 - 2. Standard: ASSE 1001.
 - 3. Size: NPS 1/4 to NPS 3, as required to match connected piping.
 - 4. Body: Bronze.
 - 5. Inlet and Outlet Connections: Threaded.
 - 6. Finish: Chrome plated.

- B. Hose-Connection Vacuum Breakers:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Arrowhead Brass Products, Inc.
 - b. Conbraco Industries, Inc.
 - c. Legend Valve.
 - d. Watts Industries, Inc.; Water Products Div.
 - e. Woodford Manufacturing Company.
 - f. Zurn Plumbing Products Group; Light Commercial Operation.
 - 2. Standard: ASSE 1001.
 - 3. Body: Bronze, nonremovable, with manual drain.
 - 4. Outlet Connection: Garden-hose threaded complying with ASME B1.20.7.
 - 5. Finish: Rough bronze.

2.3 HOSE BIBBS

- A. Hose Bibbs:
 - 1. Standard: ASME A112.18.1 for sediment faucets.
 - 2. Body Material: Bronze.
 - 3. Seat: Bronze, replaceable.
 - 4. Supply Connections: NPS 3/4 threaded or solder-joint inlet.
 - 5. Outlet Connection: Garden-hose thread complying with ASME B1.20.7.
 - 6. Pressure Rating: 125 psig.
 - 7. Vacuum Breaker: Integral or field-installation, nonremovable, drainable, hose-connection vacuum breaker complying with ASSE 1011.
 - 8. Finish for Equipment Rooms: Rough bronze, or chrome or nickel plated.
 - 9. Finish for Service Areas: Rough bronze.
 - 10. Finish for Finished Rooms: Chrome or nickel plated.
 - 11. Operation for Equipment Rooms: Chrome plates steel wheel handle.
 - 12. Operation for Outside Areas: Chrome plated wheel handle.
 - 13. Include operating key with each operating-key hose bibb.
 - 14. Include integral wall flange with each chrome- or nickel-plated hose bibb.

2.4 DRAIN VALVES

- A. Ball-Valve-Type, Hose-End Drain Valves:
 - 1. Standard: MSS SP-110 for standard-port, two-piece ball valves.
 - 2. Pressure Rating: 400-psig minimum CWP.
 - 3. Size: NPS 3/4.
 - 4. Body: Copper alloy.
 - 5. Ball: Chrome-plated brass.
 - 6. Seats and Seals: Replaceable.

7. Handle: Vinyl-covered steel.
8. Inlet: Threaded or solder joint.
9. Outlet: Threaded, short nipple with garden-hose thread complying with ASME B1.20.7 and cap with brass chain.

2.5 WATER HAMMER ARRESTERS

A. Water Hammer Arresters:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. AMTROL, Inc.
 - b. Josam Company.
 - c. PPP Inc.
 - d. Sioux Chief Manufacturing Company, Inc.
 - e. Watts Drainage Products Inc.
2. Standard: ASSE 1010 or PDI-WH 201.
3. Type: Copper tube with piston.
4. Size: ASSE 1010, Sizes AA and A through F or PDI-WH 201, Sizes A through F.

2.6 STRAINERS FOR DOMESTIC WATER PIPING

A. Y-Pattern Strainers:

1. Pressure Rating: 125 psig minimum unless otherwise indicated.
2. Body: Bronze for NPS 2 and smaller; cast iron with interior lining that complies with AWWA C550 or that is FDA approved, epoxy coated and for NPS 2-1/2 and larger.
3. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.
4. Screen: Stainless steel with round perforations unless otherwise indicated.
5. Perforation Size:
 - a. Strainers NPS 2 and Smaller: 0.020 inch.
 - b. Strainers NPS 2-1/2 to NPS 4: 0.045 inch.
6. Drain: Factory-installed, hose-end drain valve.

B. Supply-Type, Trap-Seal Primer Device:

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - a. Precision Plumbing Products, Inc.
 - b. Sioux Chief Manufacturing Company, Inc.
 - c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - d. Watts; a division of Watts Water Technologies, Inc.; Watts Regulator Company.
2. Standard: ASSE 1018.
3. Pressure Rating: 125 psig minimum.
4. Body: Bronze.
5. Inlet and Outlet Connections: NPS 1/2 threaded, union, or solder joint.
6. Gravity Drain Outlet Connection: NPS 1/2 threaded or solder joint.
7. Finish: Chrome plated, or rough bronze for units used with pipe or tube that is not chrome finished.

C. Drainage-Type, Trap-Seal Primer Device:

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - a. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
2. Standard: ASSE 1044, lavatory P-trap with NPS 3/8 minimum, trap makeup connection.
3. Size: NPS 1-1/4 minimum.
4. Material: Chrome-plated, cast brass.

3.1 INSTALLATION

- A. Refer to Division 22 Section "Common Work Results for Plumbing" for piping joining materials, joint construction, and basic installation requirements.
- B. Install Y-pattern strainers for water on supply side of each solenoid valve and pump.
- C. Install water hammer arresters in water piping according to PDI-WH 201.
- D. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping and specialties.
- E. Install supply-type, trap-seal primer valves with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting. Adjust valve for proper flow.
- F. Install drainage-type, trap-seal primer valves as lavatory trap with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting.
- G. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit. Nameplates and signs are specified in Division 22 Section "Identification for Plumbing Piping and Equipment."

3.2 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
 - 1. Test each pressure vacuum breaker according to authorities having jurisdiction and the device's reference standard.
- B. Domestic water piping specialties will be considered defective if they do not pass tests and inspections.
- C. Prepare test and inspection reports.

3.3 ADJUSTING

- A. Set field-adjustable pressure set points of water pressure-reducing valves.
- B. Set field-adjustable flow of balancing valves.
- C. Set field-adjustable temperature set points of temperature-actuated water mixing valves.

END OF SECTION 21 11 19

SECTION 22 13 16 - SANITARY WASTE AND VENT PIPING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following soil and waste, sanitary drainage and vent piping inside the building:
 - 1. Pipe, tube, and fittings.
 - 2. Special pipe fittings.
- B. Related Sections: Division 22 Section "Sanitary Sewerage Pumps" for effluent and sewage pumps.

1.2 PERFORMANCE REQUIREMENTS

- A. Components and installation shall be capable of withstanding the following minimum working pressure unless otherwise indicated:
 - 1. Soil, Waste, and Vent Piping: 10-foot head of water.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.

1.4 INFORMATIONAL SUBMITTALS

- A. Seismic Qualification Certificates: For waste and vent piping, accessories, and components, from manufacturer.
 - 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 - 2. Detailed description of piping anchorage devices on which the certification is based and their installation requirements.
- B. Field quality-control reports.

1.5 QUALITY ASSURANCE

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- B. Comply with NSF/ANSI 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-dwv" for plastic drain, waste, and vent piping and "NSF-sewer" for plastic sewer piping.

1.6 PROJECT CONDITIONS

- A. Interruption of Existing Sanitary Waste Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:
 - 1. Notify Owner no fewer than 5 days in advance of proposed interruption of sanitary waste service.

2. Do not proceed with interruption of sanitary waste service without Owner's written permission.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

- A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

2.2 HUB-AND-SPIGOT, CAST-IRON SOIL PIPE AND FITTINGS

- A. Pipe and Fittings: ASTM A 74, Service class.
- B. Gaskets: ASTM C 564, rubber.

2.3 HUBLESS, CAST-IRON SOIL PIPE AND FITTINGS

- A. Pipe and Fittings: ASTM A 888 or CISPI 301.
- B. CISPI, Hubless-Piping Couplings:
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ANACO-Husky.
 - b. Fernco Inc.
 - c. Mission Rubber Company; a division of MCP Industries, Inc.
 - d. Tyler Pipe.
 2. Standards: ASTM C 1277 and CISPI 310.
 3. Description: Stainless-steel corrugated shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.
- C. Heavy-Duty, Hubless-Piping Couplings:
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ANACO-Husky.
 - b. Clamp-All Corp.
 - c. Mission Rubber Company; a division of MCP Industries, Inc.
 - d. Tyler Pipe.
 2. Standards: ASTM C 1277 and ASTM C 1540.
 3. Description: Stainless-steel shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.

2.4 COPPER TUBE AND FITTINGS

- A. Copper DWV Tube: ASTM B 306, drainage tube, drawn temper.
- B. Copper Drainage Fittings: ASME B16.23, cast copper or ASME B16.29, wrought copper, solder-joint fittings.
- C. Hard Copper Tube: ASTM B 88, Type L and Type M, water tube, drawn temper.
- D. Soft Copper Tube: ASTM B 88, Type L, water tube, annealed temper.

- E. Copper Pressure Fittings:
 - 1. Copper Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.
 - 2. Copper Unions: MSS SP-123, copper-alloy, hexagonal-stock body with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.

- F. Copper Flanges: ASME B16.24, Class 150, cast copper with solder-joint end.
 - 1. Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.

- G. Solder: ASTM B 32, lead free with ASTM B 813, water-flushable flux.

2.5 PVC PIPE AND FITTINGS

- A. Solid-Wall PVC Pipe: ASTM D 2665, drain, waste, and vent.

- B. PVC Socket Fittings: ASTM D 2665, made to ASTM D 3311, drain, waste, and vent patterns and to fit Schedule 40 pipe.

- C. Adhesive Primer: ASTM F 656.
 - 1. Adhesive primer 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."

- D. Solvent Cement: ASTM D 2564.
 - 1. Solvent cement 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."

2.6 SPECIALTY PIPE FITTINGS

- A. Transition Couplings:
 - 1. General Requirements: Fitting or device for joining piping with small differences in OD's or of different materials. Include end connections same size as and compatible with pipes to be joined.
 - 2. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.
 - 3. Unshielded, Nonpressure Transition Couplings:
 - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) Dallas Specialty & Mfg. Co.
 - 2) Fernco Inc.
 - 3) Mission Rubber Company; a division of MCP Industries, Inc.
 - 4) Plastic Oddities; a division of Diverse Corporate Technologies, Inc.
 - b. Standard: ASTM C 1173.
 - c. Description: Elastomeric, sleeve-type, reducing or transition pattern. Include shear ring and corrosion-resistant-metal tension band and tightening mechanism on each end.
 - d. Sleeve Materials:
 - 1) For Cast-Iron Soil Pipes: ASTM C 564, rubber.
 - 2) For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
 - 3) For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.
 - 4. Pressure Transition Couplings:
 - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) Cascade Waterworks Mfg. Co.
 - 2) Dresser, Inc.

- 3) EBAA Iron, Inc.
 - 4) JCM Industries, Inc.
 - 5) Romac Industries, Inc.
 - 6) Smith-Blair, Inc.; a Sensus company.
 - 7) The Ford Meter Box Company, Inc.
 - 8) Viking Johnson.
 - b. Standard: AWWA C219.
 - c. Description: Metal, sleeve-type same size as, with pressure rating at least equal to, and ends compatible with, pipes to be joined.
 - d. Center-Sleeve Material: Manufacturer's standard.
 - e. Gasket Material: Natural or synthetic rubber.
 - f. Metal Component Finish: Corrosion-resistant coating or material.
- B. Dielectric Fittings:
1. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.
 2. Dielectric Unions:
 - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) Capitol Manufacturing Company.
 - 2) Central Plastics Company.
 - 3) Hart Industries International, Inc.
 - 4) Jomar International Ltd.
 - 5) Matco-Norca, Inc.
 - 6) McDonald, A. Y. Mfg. Co.
 - 7) Watts Regulator Co.; a division of Watts Water Technologies, Inc.
 - 8) Wilkins; a Zurn company.
 - b. Description:
 - 1) Standard: ASSE 1079.
 - 2) Pressure Rating: 125 psig minimum at 180 deg F.
 - 3) End Connections: Solder-joint copper alloy and threaded ferrous.
 3. Dielectric Flanges:
 - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) Capitol Manufacturing Company.
 - 2) Central Plastics Company.
 - 3) Matco-Norca, Inc.
 - 4) Watts Regulator Co.; a division of Watts Water Technologies, Inc.
 - 5) Wilkins; a Zurn company.
 - b. Description:
 - 1) Standard: ASSE 1079.
 - 2) Factory-fabricated, bolted, companion-flange assembly.
 - 3) Pressure Rating: 125 psig minimum at 180 deg F.
 - 4) End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

PART 3 - EXECUTION

3.1 PIPING SCHEDULE

- A. Flanges and unions may be used on aboveground pressure piping unless otherwise indicated.
- B. Aboveground, soil and waste piping NPS 4 and smaller shall be any of the following:
 1. Hubless, cast-iron soil pipe and fittings; CISPI, hubless-piping couplings; and coupled joints.
 2. Service class, cast-iron soil piping; gaskets; and gasketed joints.

- C. Aboveground, vent piping NPS 4 and smaller shall be any of the following:
 - 1. Hubless, cast-iron soil pipe and fittings; CISPI, hubless-piping couplings; and coupled joints.
- D. Underground, soil, waste, and vent piping NPS 4 and smaller shall be any of the following:
 - 1. Service class, cast-iron soil piping; gaskets; and gasketed joints.
- E. Aboveground, condensate and miscellaneous drainage, NPS 4 and shall be any of the following:
 - 1. Copper, Type K with soldered joints.
 - 2. PVC, Schedule 40 with DWV joints, solvent welded.

3.2 PIPING INSTALLATION

- A. Sanitary sewer piping outside the building is specified in Division 22 Section "Facility Sanitary Sewers."
- B. Each horizontal sanitary and storm drainage pipe shall be provided with a clean out at the upstream end of the pipe and in changes in direction greater than 45 degrees. Offset cleanouts so that they are not located in classrooms or building entrances whenever possible.
- C. Cleanouts shall be provided at 50' intervals for horizontal sanitary drain pipes of 3" or less and 80' intervals for pipes 4" and larger in accordance with the SPC.
- D. Basic piping installation requirements are specified in Division 22 Section "Common Work Results for Plumbing."
- E. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.
- F. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
- G. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- H. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- I. Install piping to permit valve servicing.
- J. Install piping at indicated slopes.
- K. Install piping free of sags and bends.
- L. Install fittings for changes in direction and branch connections.
- M. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers.
- N. Install cast-iron sleeve with water stop and mechanical sleeve seal at each service pipe penetration through foundation wall. Select number of interlocking rubber links required to make installation watertight. Sleeves and mechanical sleeve seals are specified in Division 22 Section "Common Work Results for Plumbing."

- O. Install wall penetration system at each service pipe penetration through foundation wall. Make installation watertight. Wall penetration systems are specified in Division 22 Section "Common Work Results for Plumbing."
- P. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."
- Q. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Use long-turn, double Y-branch and 1/8-bend fittings if 2 fixtures are installed back to back or side by side with common drain pipe. Straight tees, elbows, and crosses may be used on vent lines. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.
- R. Lay buried building drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.
- S. Install soil and waste drainage and vent piping at the following minimum slopes unless otherwise indicated:
 - 1. Building Sanitary Drain: 2 percent downward in direction of flow for piping NPS 2-1/2 and smaller; 1 percent downward in direction of flow for piping NPS 3 and larger.
 - 2. Horizontal Sanitary Drainage Piping: 2 percent downward in direction of flow.
 - 3. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.
- T. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."
- U. Plumbing Specialties:
 - 1. Install backwater valves in sanitary waste gravity-flow piping. Comply with requirements for backwater valves specified in Division 22 Section "Sanitary Waste Piping Specialties."
 - 2. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers in sanitary drainage gravity-flow piping. Install cleanout fitting with closure plug inside the building in sanitary drainage force-main piping. Comply with requirements for cleanouts specified in Division 22 Section "Sanitary Waste Piping Specialties."
 - 3. Install drains in sanitary drainage gravity-flow piping. Comply with requirements for drains specified in Division 22 Section "Sanitary Waste Piping Specialties."
- V. Install soil and waste drainage and vent piping at the following minimum slopes, unless otherwise indicated:
 - 1. Building Sanitary Drain: 2 percent downward in direction of flow for piping NPS 3 and smaller; 1 percent downward in direction of flow for piping NPS 4 and larger.
 - 2. Horizontal Sanitary Drainage Piping: 2 percent downward in direction of flow.
 - 3. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.
- W. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Division 22 Section "Common Work Results for Plumbing."
- X. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Division 22 Section "Common Work Results for Plumbing."

- Y. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Division 22 Section "Common Work Results for Plumbing."
- Z. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

3.3 SPECIALTY PIPE FITTING INSTALLATION

- A. Transition Couplings:
 - 1. Install transition couplings at joints of piping with small differences in OD's.
 - 2. In Drainage Piping: Unshielded, nonpressure transition couplings.
- B. Dielectric Fittings:
 - 1. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.
 - 2. Dielectric Fittings for NPS 2 and Smaller: Use dielectric unions.
 - 3. Dielectric Fittings for NPS 2-1/2 to NPS 4: Use dielectric flanges.

3.4 JOINT CONSTRUCTION

- A. Basic piping joint construction requirements are specified in Division 22 Section "Common Work Results for Plumbing."
- B. Cast-Iron, Soil-Piping Joints: Make joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."
 - 1. Gasketed Joints: Make with rubber gasket matching class of pipe and fittings.
 - 2. Hubless Joints: Make with rubber gasket and sleeve or clamp.

3.5 VALVE INSTALLATION

- A. General-duty valves are specified in Division 22 Section "General-Duty Valves for Plumbing Piping."
- B. Shutoff Valves: Install shutoff valve on each sewage pump discharge.
 - 1. Use gate or full-port ball valve for piping NPS 2 and smaller.
 - 2. Use gate valve for piping NPS 2-1/2 and larger.
- C. Check Valves: Install swing check valve, downstream from shutoff valve, on each sewage pump discharge.
- D. Backwater Valves: Install backwater valves in piping subject to sewage backflow.
 - 1. Horizontal Piping: Horizontal backwater valves.
 - 2. Floor Drains: Drain outlet backwater valves, unless drain has integral backwater valve.
 - 3. Install backwater valves in accessible locations.
 - 4. Backwater valves are specified in Division 22 Section "Sanitary Waste Piping Specialties."

3.6 HANGER AND SUPPORT INSTALLATION

- A. Pipe hangers and supports are specified in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment." Install the following:
 - 1. Vertical Piping: MSS Type 8 or Type 42, clamps.
 - 2. Individual, Straight, Horizontal Piping Runs: According to the following:
 - a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.

- b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
 - c. Longer Than 100 Feet, if Indicated: MSS Type 49, spring cushion rolls.
 3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
 4. Base of Vertical Piping: MSS Type 52, spring hangers.
- B. Install supports according to Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment."
 - C. Support horizontal piping and tubing within 12 inches of each fitting, valve, and coupling.
 - D. Support vertical piping and tubing at base and at each floor.
 - E. Rod diameter may be reduced one size for double-rod hangers, with 3/8-inch minimum rods.
 - F. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:
 1. NPS 1-1/2 and NPS 2: 60 inches with 3/8-inch rod.
 2. NPS 3: 60 inches with 1/2-inch rod.
 3. NPS 4 and NPS 5: 60 inches with 5/8-inch rod.
 4. Spacing for 10-foot lengths may be increased to 10 feet. Spacing for fittings is limited to 60 inches.
 - G. Install supports for vertical cast-iron soil piping every 15 feet.
 - H. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:
 1. NPS 1-1/4: 72 inches with 3/8-inch rod.
 2. NPS 1-1/2 and NPS 2: 96 inches with 3/8-inch rod.
 3. NPS 2-1/2: 108 inches with 1/2-inch rod.
 4. NPS 3 and NPS 5: 10 feet with 1/2-inch rod.
 - I. Install supports for vertical copper tubing every 10 feet.
 - J. Install hangers for PVC piping with the following maximum horizontal spacing and minimum rod diameters:
 1. NPS 1-1/2 and NPS 2: 48 inches with 3/8-inch rod.
 - K. Install supports for vertical PVC piping every 15 inches.
 - L. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.
- 3.7 CONNECTIONS
- A. Drawings indicate general arrangement of piping, fittings, and specialties.
 - B. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.
 - C. Connect drainage and vent piping to the following:
 1. Plumbing Fixtures: Connect drainage piping in sizes indicated, but not smaller than required by plumbing code.
 2. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by authorities having jurisdiction.
 3. Plumbing Specialties: Connect drainage and vent piping in sizes indicated, but not smaller than required by plumbing code.

4. Install test tees (wall cleanouts) in conductors near floor and floor cleanouts with cover flush with floor.
 5. Comply with requirements for backwater valves, cleanouts, and drains specified in Division 22 Section "Sanitary Waste Piping Specialties."
 6. Equipment: Connect drainage piping as indicated. Provide shutoff valve if indicated and union for each connection. Use flanges instead of unions for connections NPS 2-1/2 and larger.
- D. Connect force-main piping to the following:
1. Sewage Pump: To sewage pump discharge.
- E. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.
- F. Make connections according to the following unless otherwise indicated:
1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
 2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.

3.8 FIELD QUALITY CONTROL

- A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.
1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
 2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
- B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.
- C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
- D. Test force-main piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:
1. Leave uncovered and unconcealed new, altered, extended, or replaced force-main piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
 2. Cap and subject piping to static-water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
 3. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
 4. Prepare reports for tests and required corrective action.
- E. Test sanitary drainage and vent piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:
1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
 2. Leave uncovered and unconcealed new, altered, extended, or replaced drainage and vent piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
 3. Roughing-in Plumbing Test Procedure: Test drainage and vent piping except outside leaders on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water. From 15 minutes before

inspection starts to completion of inspection, water level must not drop. Inspect joints for leaks.

4. Finished Plumbing Test Procedure: After plumbing fixtures have been set and traps filled with water, test connections and prove they are gastight and watertight. Plug vent-stack openings on roof and building drains where they leave building. Introduce air into piping system equal to pressure of 1-inch wg. Use U-tube or manometer inserted in trap of water closet to measure this pressure. Air pressure must remain constant without introducing additional air throughout period of inspection. Inspect plumbing fixture connections for gas and water leaks.
5. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
6. Prepare reports for tests and required corrective action.

3.9 CLEANING

- A. Clean interior of piping. Remove dirt and debris as work progresses.
- B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.
- C. Place plugs in ends of uncompleted piping at end of day and when work stops.

3.10 PROTECTION

- A. Exposed PVC Piping: Protect plumbing drainage and plumbing vents exposed to sunlight with two coats of water-based latex paint.

END OF SECTION 221316

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following sanitary drainage piping specialties:
 - 1. Cleanouts.
 - 2. Floor drains.
 - 3. Roof flashing assemblies.
 - 4. Through-penetration firestop assemblies.
 - 5. Miscellaneous sanitary drainage piping specialties.
 - 6. Flashing materials.
- B. Related Sections include the following:
 - 1. Division 22 Section "Storm Drainage Piping Specialties" for trench drains for storm water, channel drainage systems for storm water, roof drains, and catch basins.
 - 2. Division 22 Section "Plumbing Fixtures" for hair interceptors.

1.2 DEFINITIONS

- A. ABS: Acrylonitrile-butadiene-styrene plastic.
- B. FOG: Fats, oils, and greases.
- C. FRP: Fiberglass-reinforced plastic.
- D. HDPE: High-density polyethylene plastic.
- E. PE: Polyethylene plastic.
- F. PP: Polypropylene plastic.
- G. PVC: Polyvinyl chloride plastic.

1.3 SUBMITTALS

- A. Shop Drawings: Show fabrication and installation details for frost-resistant vent terminals.
 - 1. Wiring Diagrams: Power, signal, and control wiring.
- B. Field quality-control test reports.
- C. Operation and Maintenance Data: For drainage piping specialties to include in emergency, operation, and maintenance manuals.

1.4 QUALITY ASSURANCE

- A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.

- 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 NSF 14, "Plastics Piping Components and Related Materials," for plastic sanitary piping specialty components.

1.5 COORDINATION

- A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.
- B. Coordinate size and location of roof penetrations.

PART 2 - PRODUCTS

2.1 CLEANOUTS

- A. Exposed Metal Cleanouts:
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
 - a. Josam Company; Josam Div.
 - b. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - c. Watts Drainage Products Inc.
 - d. Zurn Plumbing Products Group; Specification Drainage Operation.
 - 2. Standard: ASME A112.36.2M for cast iron for cleanout test tee.
 - 3. Size: Same as connected drainage piping
 - 4. Body Material: Hubless, cast-iron soil pipe test tee as required to match connected piping.
 - 5. Closure: Countersunk plug.
 - 6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.
 - 7. Closure: Stainless-steel plug with seal.
- B. Metal Floor Cleanouts:
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
 - a. Josam Company; Josam Div.
 - b. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - c. Watts Drainage Products Inc.
 - d. Zurn Plumbing Products Group; Specification Drainage Operation.
 - 2. Standard: ASME A112.36.2M for heavy-duty, adjustable housing cleanout.
 - 3. Size: Same as connected branch.
 - 4. Type: Heavy-duty, adjustable housing.
 - 5. Body or Ferrule: Cast iron.
 - 6. Clamping Device: Required.
 - 7. Outlet Connection: Inside calk.
 - 8. Closure: Brass plug with straight threads and gasket.
 - 9. Adjustable Housing Material: Cast iron with threads.
 - 10. Frame and Cover Material and Finish: Stainless steel.
 - 11. Frame and Cover Shape: Round.
 - 12. Top Loading Classification: Heavy Duty.
 - 13. Riser: ASTM A 74, Service class, cast-iron drainage pipe fitting and riser to cleanout.
 - 14. Standard: ASME A112.3.1.
 - 15. Size: Same as connected branch.

16. Housing: Stainless steel.
17. Closure: Stainless steel with seal.
18. Riser: Stainless-steel drainage pipe fitting to cleanout.

C. Cast-Iron Wall Cleanouts:

1. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
 - a. Josam Company; Josam Div.
 - b. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - c. Watts Drainage Products Inc.
 - d. Zurn Plumbing Products Group; Specification Drainage Operation.
2. Standard: ASME A112.36.2M. Include wall access.
3. Size: Same as connected drainage piping.
4. Body: Hubless, cast-iron soil pipe test tee as required to match connected piping.
5. Closure: Countersunk plug.
6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.
7. Wall Access: Round, deep, chrome-plated bronze cover plate with screw.
8. Wall Access: Round, nickel-bronze, copper-alloy, or stainless-steel wall-installation frame and cover.

2.2 FLOOR DRAINS

A. Cast-Iron Floor Drains:

1. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
 - a. Josam Company; Josam Div.
 - b. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - c. Watts Drainage Products Inc.
 - d. Zurn Plumbing Products Group; Specification Drainage Operation.
2. Standard: ASME A112.6.3 with backwater valve.
3. See plumbing schedule and details for all other requirements.

2.3 ROOF FLASHING ASSEMBLIES

A. Roof Flashing Assemblies:

1. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following or approved equal:
 - a. Acorn Engineering Company; Elmdor/Stoneman Div.
 - b. Thaler Metal Industries Ltd.

B. Description: Manufactured assembly made of 4.0-lb/sq. ft., 0.0625-inch- thick, lead flashing collar and skirt extending at least 6 inches from pipe, with galvanized-steel boot reinforcement and counterflashing fitting.

1. Open-Top Vent Cap: Without cap.
2. Low-Silhouette Vent Cap: With vandal-proof vent cap.
3. Extended Vent Cap: With field-installed, vandal-proof vent cap.

2.4 THROUGH-PENETRATION FIRESTOP ASSEMBLIES

A. Through-Penetration Firestop Assemblies:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ProSet Systems Inc.
 - b. UL
 - c. Hilti
2. Standard: UL 1479 assembly of sleeve and stack fitting with firestopping plug.
3. Size: Same as connected soil, waste, or vent stack.
4. Sleeve: Molded PVC plastic, of length to match slab thickness and with integral nailing flange on one end for installation in cast-in-place concrete slabs.
5. Stack Fitting: ASTM A 48/A 48M, gray-iron, hubless-pattern, wye branch with neoprene O-ring at base and gray-iron plug in thermal-release harness. Include PVC protective cap for plug.
6. Special Coating: Corrosion resistant on interior of fittings.

2.5 MISCELLANEOUS SANITARY DRAINAGE PIPING SPECIALTIES

A. Oil Water Separator:

1. Provide above slab oil water separator as specified on the Drawings. The grease trap shall meet all requirements of The Florida Building Code, Plumbing.

B. Open Drains:

1. Description: Shop or field fabricate from ASTM A 74, Service class, hub-and-spigot, cast-iron, soil-pipe fittings. Include P-trap, hub-and-spigot riser section; and where required, increaser fitting joined with ASTM C 564, rubber gaskets.
2. Size: Same as connected waste piping with increaser fitting of size indicated.

C. Deep-Seal Traps:

1. Description: Cast-iron or bronze casting, with inlet and outlet matching connected piping and cleanout trap-seal primer valve connection.
2. Size: Same as connected waste piping.
 - a. NPS 2: 4-inch- minimum water seal.
 - b. NPS 2-1/2 and Larger: 5-inch- minimum water seal.

D. Air-Gap Fittings:

1. Standard: ASME A112.1.2, for fitting designed to ensure fixed, positive air gap between installed inlet and outlet piping.
2. Body: Bronze or cast iron.
3. Inlet: Opening in top of body.
4. Outlet: Larger than inlet.
5. Size: Same as connected waste piping and with inlet large enough for associated indirect waste piping.

E. Sleeve Flashing Device:

1. Description: Manufactured, cast-iron fitting, with clamping device, that forms sleeve for pipe floor penetrations of floor membrane. Include galvanized-steel pipe extension in top

of fitting that will extend 1 inch above finished floor and galvanized-steel pipe extension in bottom of fitting that will extend through floor slab.

2. Size: As required for close fit to riser or stack piping.

F. Stack Flashing Fittings:

1. Description: Counterflashing-type, cast-iron fitting, with bottom recess for terminating roof membrane, and with threaded or hub top for extending vent pipe.
2. Size: Same as connected stack vent or vent stack.

G. Vent Caps:

1. Description: Cast-iron body with threaded or hub inlet and vandal-proof design. Include vented hood and setscrews to secure to vent pipe.
2. Size: Same as connected stack vent or vent stack.

H. Expansion Joints:

1. Standard: ASME A112.21.2M.
2. Body: Cast iron with bronze sleeve, packing, and gland.
3. End Connections: Matching connected piping.
4. Size: Same as connected soil, waste, or vent piping.

2.6 FLASHING MATERIALS

A. Lead Sheet: ASTM B 749, Type L51121, copper bearing, with the following minimum weights and thicknesses, unless otherwise indicated:

1. General Use: 4.0-lb/sq. ft., 0.0625-inch thickness.
2. Vent Pipe Flashing: 3.0-lb/sq. ft., 0.0469-inch thickness.
3. Burning: 6-lb/sq. ft., 0.0938-inch thickness.

B. Copper Sheet: ASTM B 152/B 152M, of the following minimum weights and thicknesses, unless otherwise indicated:

1. General Applications: 12 oz./sq. ft..
2. Vent Pipe Flashing: 8 oz./sq. ft..

C. Zinc-Coated Steel Sheet: ASTM A 653/A 653M, with 0.20 percent copper content and 0.04-inch minimum thickness, unless otherwise indicated. Include G90 hot-dip galvanized, mill-phosphatized finish for painting if indicated.

D. Elastic Membrane Sheet: ASTM D 4068, flexible, chlorinated polyethylene, 40-mil minimum thickness.

E. Fasteners: Metal compatible with material and substrate being fastened.

F. Metal Accessories: Sheet metal strips, clamps, anchoring devices, and similar accessory units required for installation; matching or compatible with material being installed.

G. Solder: ASTM B 32, lead-free alloy.

H. Bituminous Coating: SSPC-Paint 12, solvent-type, bituminous mastic.

3.1 INSTALLATION

- A. Refer to Division 22 Section "Common Work Results for Plumbing" for piping joining materials, joint construction, and basic installation requirements.
- B. Install backwater valves in building drain piping. For interior installation, provide cleanout deck plate flush with floor and centered over backwater valve cover, and of adequate size to remove valve cover for servicing.
- C. Each building drain shall be provided with a two-way grade cleanout within 6' of the junction of the building drain and building sewer immediately after exiting the building. If the two-way cleanout is installed in a grassy area, it shall be embedded in an 18"x18"x4" thick concrete pad.
- D. Each horizontal sanitary and storm drainage pipe shall be provided with a clean out at the upstream end of the pipe and in changes in direction greater than 45 degrees. Offset cleanouts so that they are not located in classrooms or building entrances whenever possible.
- E. Cleanouts shall be provided at 50' intervals for horizontal sanitary drain pipes of 3" or less and 80' intervals for pipes 4" and larger.
- F. Cleanout plug will be encompasses in a concrete pad the measures a minimum of 18" square and 6" inches in depth.
- G. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:
 - 1. Size same as drainage piping up to NPS 4. Use NPS 4 for larger drainage piping unless larger cleanout is indicated.
 - 2. Locate at each change in direction of piping greater than 45 degrees.
 - 3. Locate at base of each vertical soil and waste stack.
- H. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.
- I. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.
- J. Install floor drains at low points of surface areas to be drained. Set grates of drains flush with finished floor, unless otherwise indicated.
 - 1. Position floor drains for easy access and maintenance.
 - 2. Set floor drains below elevation of surrounding finished floor to allow floor drainage. Set with grates depressed according to the following drainage area radii:
 - a. Radius, 30 Inches or Less: Equivalent to 1 percent slope, but not less than 1/4-inch total depression.
 - b. Radius, 30 to 60 Inches: Equivalent to 1 percent slope.
 - c. Radius, 60 Inches or Larger: Equivalent to 1 percent slope, but not greater than 1-inch total depression.
 - 3. Install floor-drain flashing collar or flange so no leakage occurs between drain and adjoining flooring. Maintain integrity of waterproof membranes where penetrated.
 - 4. Install individual traps for floor drains connected to sanitary building drain, unless otherwise indicated.
- K. Trap guard inserts shall be installed in accordance with the manufacturer's instructions and the requirements of the applicable codes.

- L. Install roof flashing assemblies on sanitary stack vents and vent stacks that extend through roof.
- M. Install flashing fittings on sanitary stack vents and vent stacks that extend through roof.
- N. Install through-penetration firestop assemblies in plastic conductors and stacks at floor penetrations.
- O. Assemble open drain fittings and install with top of hub 1 inch above floor.
- P. Install deep-seal traps on floor drains and other waste outlets.
- Q. Install floor-drain, trap-seal primer fittings or trap guards (if allowed by the local AHJ) on inlet to floor drains that require trap-seal primer connection.
 - 1. Exception: Fitting may be omitted if trap has trap-seal primer connection.
 - 2. Size: Same as floor drain inlet.
- R. Install air-gap fittings on indirect-waste piping discharge into sanitary drainage system.
- S. Install sleeve flashing device with each riser and stack passing through floors with waterproof membrane.
- T. Install vent caps on each vent pipe passing through roof.
- U. Install expansion joints on vertical stacks and conductors. Position expansion joints for easy access and maintenance.
- V. Install grease interceptors, including trapping, venting, and flow-control fitting, according to authorities having jurisdiction and with clear space for servicing.
 - 1. Flush with Floor Installation: Set unit and extension, if required, with cover flush with finished floor.
 - 2. Recessed Floor Installation: Set unit in receiver housing having bottom or cradle supports, with receiver housing cover flush with finished floor.
 - 3. Install cleanout immediately downstream from interceptors not having integral cleanout on outlet.
- W. Install wood-blocking reinforcement for wall-mounting-type specialties.
- X. Install traps on plumbing specialty drain outlets. Omit traps on indirect wastes unless trap is indicated.
- Y. Install escutcheons at wall, floor, and ceiling penetrations in exposed finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding pipe fittings.

3.2 CONNECTIONS

- A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to equipment to allow service and maintenance.
- C. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."
- D. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.3 FLASHING INSTALLATION

- A. Fabricate flashing from single piece unless large pans, sumps, or other drainage shapes are required. Join flashing according to the following if required:
 - 1. Lead Sheets: Burn joints of lead sheets 6.0-lb/sq. ft., 0.0938-inch thickness or thicker. Solder joints of lead sheets 4.0-lb/sq. ft., 0.0625-inch thickness or thinner.
 - 2. Copper Sheets: Solder joints of copper sheets.
- B. Install sheet flashing on pipes, sleeves, and specialties passing through or embedded in floors and roofs with waterproof membrane.
 - 1. Pipe Flashing: Sleeve type, matching pipe size, with minimum length of 10 inches, and skirt or flange extending at least 8 inches around pipe.
 - 2. Sleeve Flashing: Flat sheet, with skirt or flange extending at least 8 inches around sleeve.
 - 3. Embedded Specialty Flashing: Flat sheet, with skirt or flange extending at least 8 inches around specialty.
- C. Set flashing on floors and roofs in solid coating of bituminous cement.
- D. Secure flashing into sleeve and specialty clamping ring or device.
- E. Install flashing for piping passing through roofs with counterflashing or commercially made flashing fittings, according to Division 07 Section "Sheet Metal Flashing and Trim."
- F. Extend flashing up vent pipe passing through roofs and turn down into pipe, or secure flashing into cast-iron sleeve having caulking recess.
- G. Fabricate and install flashing and pans, sumps, and other drainage shapes.

3.4 LABELING AND IDENTIFYING

- A. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each grease interceptor.
- B. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit. Nameplates and signs are specified in Division 22 Section "Identification for Plumbing Piping and Equipment."

3.5 PROTECTION

- A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.
- B. Protect elastomeric trap guard inserts from being touched with solvent cement or primers during installation.
- C. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION 221319

SECTION 22 40 00 - PLUMBING FIXTURES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Janitor's sink.
 - 2. Emergency Shower with Eyewash Combination Units.

1.2 DEFINITIONS

- A. Solid Surface: Nonporous, homogeneous, cast-polymer-plastic material with heat-, impact-, scratch-, and stain-resistance qualities.

1.3 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of all plumbing fixtures and related components covered in this specification section that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Faulty operation of fixtures, flush valves and faucets.
 - b. Deterioration of metals, metal finishes, and other materials beyond normal use.
 - 2. Warranty Period(s): From date of Substantial Completion:
 - a. Five years.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Diagram power, signal, and control wiring.
- C. Operation and maintenance data.
- D. Warranty.

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. Regulatory Requirements: Comply with requirements in ICC A117.1, "Accessible and Usable Buildings and Facilities"; Public Law 90-480, "Architectural Barriers Act"; and Public Law 101-336, "Americans with Disabilities Act"; for plumbing fixtures for people with disabilities.
- C. Regulatory Requirements: Comply with requirements in Public Law 102-486, "Energy Policy Act," about water flow and consumption rates for plumbing fixtures.
- D. NSF Standard: Comply with NSF 61, "Drinking Water System Components--Health Effects," for fixture materials that will be in contact with potable water.
- E. Select combinations of fixtures and trim, faucets, fittings, and other components that are compatible.
- F. Comply with the following applicable standards and other requirements specified for plumbing fixtures:
 - 1. Enameled, Cast-Iron Fixtures: ASME A112.19.1M.
 - 2. Porcelain-Enameled, Formed-Steel Fixtures: ASME A112.19.4M.
- G. Comply with the following applicable standards and other requirements specified for faucets:
 - 1. Backflow Protection Devices for Faucets with Hose-Thread Outlet: ASME A112.18.3M.
 - 2. Supply Fittings: ASME A112.18.1.
 - 3. Brass Waste Fittings: ASME A112.18.2.
- H. Comply with the following applicable standards and other requirements specified for miscellaneous fittings:
 - 1. Atmospheric Vacuum Breakers: ASSE 1001.
 - 2. Brass and Copper Supplies: ASME A112.18.1.
- I. Comply with the following applicable standards and other requirements specified for miscellaneous components:
 - 1. Flexible Water Connectors: ASME A112.18.6.
 - 2. Hose-Coupling Threads: ASME B1.20.7.
 - 3. Pipe Threads: ASME B1.20.1.

PART 2 - PRODUCTS

- 2.1 Emergency Shower with Eyewash Combination Units ES/EW:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Acorn Safety; a division of Acorn Engineering Company.
 - b. Bradley Corporation.
 - c. Encon Safety Products.
 - d. Guardian Equipment Co.
 - e. Haws Corporation.
 - f. Speakman Company.
 - 2. Piping:

- a. Material: Galvanized steel.
 - b. Unit Supply: NPS 1-1/4 minimum.
 - c. Unit Drain: Outlet at back or side near bottom.
3. Shower:
- a. Capacity: Not less than 20 gpm for at least 15 minutes.
 - b. Supply Piping: NPS 1 with flow regulator and stay-open control valve.
 - c. Control-Valve Actuator: Pull rod.
 - d. Shower Head: Chrome-plated brass or stainless steel.
4. Eyewash Unit:
- a. Capacity: Not less than 0.4 gpm for at least 15 minutes.
 - b. Supply Piping: NPS 1/2 with flow regulator and stay-open control valve.
 - c. Control-Valve Actuator: Paddle.
 - d. Spray-Head Assembly: Two receptor-mounted spray heads.
 - e. Receptor: Chrome-plated brass or stainless-steel bowl.
 - f. Mounting: Attached shower pedestal.

2.2 MOP SINKS

A. Mop Sinks <MS-1>: Cast Iron, Floor Mounted.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Crane Plumbing, L.L.C.
 - b. Fiat Products.
 - c. Mustee, E. L., & Sons, Inc.
 - d. Zurn Industries, LLC; Light Commercial Specialty Plumbing Products.
2. Fixture:
 - a. Standard: IAPMO/ANSI Z124.6.
 - b. Material: Cast Iron.
 - c. Nominal Size: As shown.
 - d. Rim Guard: Stainless steel. On front top surfaces.
 - e. Wall Guard: Stainless steel.
 - f. Mop Hanger.
 - g. Hose and Hose Bracket.
 - h. Drain: Grid with integral p-trap outlet.
3. Mounting: On floor and flush to wall.

B. Faucet: Manual type, dual-control, dual-temperature mixing valve.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Chicago Faucets.
 - b. Delta Faucet Company.
 - c. Elkay Manufacturing Co.
 - d. Just Manufacturing.

- e. T & S Brass and Bronze Works, Inc.
 - f. Zurn Industries, LLC; Commercial Brass and Fixtures.
2. Standard: ASME A112.18.1/CSA B125.1.
 3. General: Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture hole punchings; coordinate outlet with spout and sink receptor.
 4. Body Type: Widespread.
 5. Body Material: Commercial, solid brass.
 6. Finish: Rough chrome finish.
 7. Maximum Flow Rate: 2.5 gpm.
 8. Handle(s): Lever.
 9. Mounting Type: Back/wall, exposed.
 10. Spout Type: Rigid, solid brass with wall brace.
 11. Vacuum Breaker: Required for hose outlet.
 12. Spout Outlet: Hose thread according to ASME B1.20.7.

2.3 SINK SUPPLY FITTINGS

- A. NSF Standard: Comply with NSF/ANSI 61, "Drinking Water System Components - Health Effects," for supply-fitting materials that will be in contact with potable water.
- B. Standard: ASME A112.18.1/CSA B125.1.
- C. Supply Piping: Chrome-plated-brass pipe or chrome-plated copper tube matching water-supply piping size. Include chrome-plated-brass or stainless-steel wall flange.
- D. Supply Stops: Chrome-plated-brass, one-quarter-turn, ball-type or compression valve with inlet connection matching supply piping.
 1. Operation: Loose key.
- E. Risers:
 1. NPS 1/2.
 2. Chrome-plated, rigid-copper-pipe and brass straight or offset tailpieces riser.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine roughing-in of water-supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before plumbing-fixture installation.
- B. Examine walls, floors, cabinets, and counters for suitable conditions where fixtures will be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Assemble plumbing fixtures, trim, fittings, and other components according to manufacturers' written instructions.
- B. Support Installation:
 - 1. Install supports, affixed to building substrate, for wall-mounting fixtures.
 - 2. Use carrier supports with waste fitting and seal for back-outlet fixtures.
 - 3. Use carrier supports without waste fitting for fixtures with tubular waste piping.
 - 4. Use chair-type carrier supports with rectangular steel uprights for accessible fixtures.
- C. Install back-outlet, wall-mounting fixtures onto waste fitting seals and attached to supports.
- D. Install floor-mounting fixtures on closet flanges or other attachments to piping or building substrate.
- E. Install wall-mounting fixtures with tubular waste piping attached to supports.
- F. Install counter-mounting fixtures in and attached to casework.
- G. Install fixtures level and plumb according to roughing-in drawings.
- H. Install accessible fixtures at mounting height for the handicapped/elderly, according to ICC/ANSI A117.1.
- I. Set floor-mounted sinks in leveling bed of cement grout.
- J. Install water-supply piping with stop on each supply to each fixture to be connected to water distribution piping. Attach supplies to supports or substrate within pipe spaces behind fixtures. Install stops in locations where they can be easily reached for operation.
 - 1. Exception: Use ball valves if supply stops are not specified with fixture. Comply with valve requirements specified in Division 22 Section "General-Duty Valves for Plumbing Piping."
 - 2. Exception: Omit shutoff valve on supply to emergency equipment if prohibited by authorities having jurisdiction.
 - 3. Install stops in locations where they can be easily reached for operation.
- K. Install trap and tubular waste piping on drain outlet of each fixture to be directly connected to sanitary drainage system.
- L. Install tubular waste piping on drain outlet of each fixture to be indirectly connected to drainage system.
- M. Install toilet seats on water closets.
- N. Install protective shielding pipe covers and enclosures on exposed supplies and waste piping of accessible lavatories.
- O. Install faucet-spout fittings with specified flow rates and patterns in faucet spouts if faucets are not available with required rates and patterns. Include adapters if required.
- P. Install traps on fixture outlets.

1. Exception: Omit trap on fixtures with integral traps.
2. Exception: Omit trap on indirect wastes unless otherwise indicated.

- Q. Install escutcheons at piping wall and ceiling penetrations in exposed, finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding fittings. Escutcheons are specified in Division 22 Section "Common Work Results for Plumbing."
- R. Install dielectric fitting in supply piping to plumbing fixtures if piping and equipment connections are made of different metals. Comply with requirements for dielectric fittings specified in Division 22 Section "Domestic Water Piping."
- S. Seal joints between fixtures and walls, floors, and countertops using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Sealants are specified in Division 07 Section "Joint Sealants."

3.3 CONNECTIONS

- A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.
- C. Comply with water piping requirements specified in Division 22 Section "Domestic Water Piping."
- D. Comply with soil and waste piping requirements specified in Division 22 Section "Sanitary Waste and Vent Piping."
- E. Ground equipment according to Division 26 Section "Grounding and Bonding."
- F. Connect wiring according to Division 26 Section "Low Voltage Conductors and Cables."

3.4 IDENTIFICATION

- A. Install equipment nameplates or equipment markers on emergency plumbing fixtures. Comply with requirements for identification materials specified in Division 22 Section "Identification for Plumbing Piping and Equipment."

3.5 FIELD QUALITY CONTROL

- A. Verify that installed plumbing fixtures are categories and types specified for locations where installed.
- B. Check that plumbing fixtures are complete with trim, faucets, fittings, and other specified components.
- C. Inspect installed plumbing fixtures for damage. Replace damaged fixtures and components.

- D. Test installed fixtures after water systems are pressurized for proper operation. Replace malfunctioning fixtures and components, then retest. Repeat procedure until units operate properly.

3.6 ADJUSTING

- A. Operate and adjust plumbing fixtures and controls. Replace damaged and malfunctioning fixtures, fittings, and controls.
- B. Adjust water pressure at faucets to produce proper flow.

3.7 CLEANING AND PROTECTION

- A. After completing installation of plumbing fixtures, inspect and repair damaged finishes.
- B. Clean plumbing fixtures, faucets, and other fittings with manufacturers' recommended cleaning methods and materials.
- C. Provide protective covering for installed plumbing fixtures and fittings.
- D. Do not allow use of plumbing fixtures for temporary facilities unless approved in writing by Owner.

END OF SECTION 22 40 00

SECTION 230500 - COMMON WORK RESULTS FOR HVAC

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Piping materials and installation instructions common to most piping systems.
2. Dielectric fittings.
3. Mechanical sleeve seals.
4. Sleeves.
5. Escutcheons.
6. Grout.
7. Equipment installation requirements common to equipment sections.
8. Supports and anchorages.

1.2 DEFINITIONS

- A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.
- B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
- C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.
- D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and chases.
- E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

1.3 SUBMITTALS

- A. Welding certificates.

1.4 QUALITY ASSURANCE

- A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."

- B. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
 - 1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
 - 2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.
- C. Electrical Characteristics for HVAC Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

PART 2 - PRODUCTS

2.1 PIPE, TUBE, AND FITTINGS

- A. Refer to individual Division 23 piping Sections for pipe, tube, and fitting materials and joining methods.
- B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

2.2 JOINING MATERIALS

- A. Refer to individual Division 23 piping Sections for special joining materials not listed below.
- B. Pipe-Flange Gasket Materials: ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch (3.2-mm) maximum thickness unless thickness or specific material is indicated.
- C. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.
- D. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.
- E. Brazing Filler Metals: AWS A5.8, BCuP Series or BAg1, unless otherwise indicated.
- F. Welding Filler Metals: Comply with AWS D10.12.
- G. Solvent Cements for Joining Plastic Piping:
 - 1. CPVC Piping: ASTM F 493.
 - 2. PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.

2.3 DIELECTRIC FITTINGS

- A. Description: Combination fitting of copper alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.
- B. Insulating Material: Suitable for system fluid, pressure, and temperature.
- C. Dielectric Unions: Factory-fabricated, union assembly, for 250-psig (1725-kPa) minimum working pressure at 180 deg F (82 deg C).
- D. Dielectric Flanges: Factory-fabricated, companion-flange assembly, for 150- or 300-psig (1035- or 2070-kPa) minimum working pressure as required to suit system pressures.
- E. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig (2070-kPa) minimum working pressure at 225 deg F (107 deg C).
- F. Dielectric Nipples: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig (2070-kPa) minimum working pressure at 225 deg F (107 deg C).

2.4 MECHANICAL SLEEVE SEALS

- A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.
- B. Sealing Elements: NBR interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
- C. Pressure Plates: Stainless steel. Include two for each sealing element.
- D. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.5 SLEEVES

- A. Galvanized-Steel Sheet: 0.0239-inch (0.6-mm) minimum thickness; round tube closed with welded longitudinal joint.
- B. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.
- C. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
- D. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.

- 1. Underdeck Clamp: Clamping ring with set screws.

- E. Molded PVC: Permanent, with nailing flange for attaching to wooden forms.
- F. PVC Pipe: ASTM D 1785, Schedule 40.
- G. Molded PE: Reusable, PE, tapered-cup shaped, and smooth-outer surface with nailing flange for attaching to wooden forms.

2.6 ESCUTCHEONS

- A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.
- B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with polished chrome-plated finish.
- C. One-Piece, Cast-Brass Type: With set screw.
 - 1. Finish: Rough brass.
- D. Split-Casting, Cast-Brass Type: With concealed hinge and set screw.
 - 1. Finish: Rough brass.

2.7 GROUT

- A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.
 - 1. Characteristics: Post-hardening, volume-adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
 - 2. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.
 - 3. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 PIPING SYSTEMS - COMMON REQUIREMENTS

- A. Install piping according to the following requirements and Division 23 Sections specifying piping systems.
- B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

- C. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.
- D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- F. Install piping to permit valve servicing.
- G. Install piping at indicated slopes.
- H. Install piping free of sags and bends.
- I. Install fittings for changes in direction and branch connections.
- J. Install piping to allow application of insulation.
- K. Select system components with pressure rating equal to or greater than system operating pressure.
- L. Install escutcheons for penetrations of walls, ceilings, and floors.
- M. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.
- N. Aboveground, Exterior-Wall Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for **1-inch (25-mm)** annular clear space between pipe and sleeve for installing mechanical sleeve seals.
 - 1. Install steel pipe for sleeves smaller than **6 inches (150 mm)** in diameter.
 - 2. Install cast-iron "wall pipes" for sleeves **6 inches (150 mm)** and larger in diameter.
 - 3. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.
- O. Underground, Exterior-Wall Pipe Penetrations: Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Select sleeve size to allow for **1-inch (25-mm)** annular clear space between pipe and sleeve for installing mechanical sleeve seals.
 - 1. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe

and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

- P. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Refer to Division 07 Section "Penetration Firestopping" for materials.
- Q. Verify final equipment locations for roughing-in.
- R. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

3.2 PIPING JOINT CONSTRUCTION

- A. Join pipe and fittings according to the following requirements and Division 23 Sections specifying piping systems.
- B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.
- E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.
- F. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
 - 1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
 - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
- G. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.
- H. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.
- I. Plastic Piping Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:

1. Comply with ASTM F 402, for safe-handling practice of cleaners, primers, and solvent cements.
 2. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.
 3. PVC Pressure Piping: Join schedule number ASTM D 1785, PVC pipe and PVC socket fittings according to ASTM D 2672. Join other-than-schedule-number PVC pipe and socket fittings according to ASTM D 2855.
 4. PVC Nonpressure Piping: Join according to ASTM D 2855.
- J. Plastic Pressure Piping Gasketed Joints: Join according to ASTM D 3139.
- K. Plastic Nonpressure Piping Gasketed Joints: Join according to ASTM D 3212.
- L. PE Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657.
1. Plain-End Pipe and Fittings: Use butt fusion.
 2. Plain-End Pipe and Socket Fittings: Use socket fusion.
- M. Fiberglass Bonded Joints: Prepare pipe ends and fittings, apply adhesive, and join according to pipe manufacturer's written instructions.

3.3 PIPING CONNECTIONS

- A. Make connections according to the following, unless otherwise indicated:
1. Install unions, in piping **NPS 2 (DN 50)** and smaller, adjacent to each valve and at final connection to each piece of equipment.
 2. Install flanges, in piping **NPS 2-1/2 (DN 65)** and larger, adjacent to flanged valves and at final connection to each piece of equipment.
 3. Dry Piping Systems: Install dielectric unions and flanges to connect piping materials of dissimilar metals.
 4. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

3.4 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

- A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.
- B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.
- C. Install HVAC equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.
- D. Install equipment to allow right of way for piping installed at required slope.

3.5 CONCRETE BASES

- A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes at Project.
 - 1. Construct concrete bases of dimensions indicated, but not less than **4 inches (100 mm)** larger in both directions than supported unit.
 - 2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on **18-inch (450-mm)** centers around the full perimeter of the base.
 - 3. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
 - 4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 5. Install anchor bolts to elevations required for proper attachment to supported equipment.
 - 6. Install anchor bolts according to anchor-bolt manufacturer's written instructions.
 - 7. Use **3000-psi (20.7-MPa)**, 28-day compressive-strength concrete and reinforcement as specified in Division 03 Section "Cast-in-Place Concrete."

3.6 ERECTION OF METAL SUPPORTS AND ANCHORAGES

- A. Refer to Division 05 Section "Metal Fabrications" for structural steel.
- B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor HVAC materials and equipment.
- C. Field Welding: Comply with AWS D1.1.

3.7 ERECTION OF WOOD SUPPORTS AND ANCHORAGES

- A. Cut, fit, and place wood grounds, nailers, blocking, and anchorages to support, and anchor HVAC materials and equipment.
- B. Select fastener sizes that will not penetrate members if opposite side will be exposed to view or will receive finish materials. Tighten connections between members. Install fasteners without splitting wood members.
- C. Attach to substrates as required to support applied loads.

3.8 GROUTING

- A. Mix and install grout for HVAC equipment base bearing surfaces, pump and other equipment base plates, and anchors.
- B. Clean surfaces that will come into contact with grout.

- C. Provide forms as required for placement of grout.
- D. Avoid air entrapment during placement of grout.
- E. Place grout, completely filling equipment bases.
- F. Place grout on concrete bases and provide smooth bearing surface for equipment.
- G. Place grout around anchors.
- H. Cure placed grout.

END OF SECTION

SECTION 230593 - TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes TAB to produce design objectives for the following:
 - 1. Air Systems:
 - a. Constant-volume air systems.
 - 2. HVAC equipment quantitative-performance settings.
 - 3. Verifying that automatic control devices are functioning properly.
 - 4. Reporting results of activities and procedures specified in this Section.

1.2 SUBMITTALS

- A. Strategies and Procedures Plan: Within 30 days from Contractor's Notice to proceed; submit 4 copies of TAB strategies and step-by-step procedures as specified in Part 3 "Preparation" Article. Include a complete set of report forms intended for use on this Project.
- B. Certified TAB Reports: Submit two copies of reports prepared, as specified in this Section, on approved forms certified by TAB firm.
- C. Warranties specified in this Section.

1.3 QUALITY ASSURANCE

- A. TAB Firm Qualifications: Engage a TAB firm certified by either AABC or NEBB.
- B. Certification of TAB Reports: Certify TAB field data reports. This certification includes the following:
 - 1. Review field data reports to validate accuracy of data and to prepare certified TAB reports.
 - 2. Certify that TAB team complied with approved TAB plan and the procedures specified and referenced in this Specification.
- C. TAB Report Forms: Use standard forms from [AABC's "National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems."] [NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems."] [SMACNA's "HVAC Systems - Testing, Adjusting, and Balancing."] [TAB firm's forms approved by Architect.]

1.4 PROJECT CONDITIONS

- A. Full Owner Occupancy: Owner will occupy the site and existing building during entire TAB period. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.
- B. Partial Owner Occupancy: Owner may occupy completed areas of building before Substantial Completion. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.

1.5 COORDINATION

- A. Coordinate the efforts of factory-authorized service representatives for systems and equipment, HVAC controls installers, and other mechanics to operate HVAC systems and equipment to support and assist TAB activities.
- B. Perform TAB after leakage and pressure tests on air and water distribution systems have been satisfactorily completed.

1.6 WARRANTY

- A. National Project Performance Guarantee: Provide a guarantee on AABC's "National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems" forms stating that AABC will assist in completing requirements of the Contract Documents if TAB firm fails to comply with the Contract Documents. Guarantee includes the following provisions:
- B. Special Guarantee: Provide a guarantee on NEBB forms stating that NEBB will assist in completing requirements of the Contract Documents if TAB firm fails to comply with the Contract Documents. Guarantee shall include the following provisions:
 - 1. The certified TAB firm has tested and balanced systems according to the Contract Documents.
 - 2. Systems are balanced to optimum performance capabilities within design and installation limits.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems' designs that may preclude proper TAB of systems and equipment.

1. Verify that balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers, are required by the Contract Documents. Verify that quantities and locations of these balancing devices are accessible and appropriate for effective balancing and for efficient system and equipment operation.
- B. Examine approved submittal data of HVAC systems and equipment.
- C. Examine Project Record Documents described in Division 01 Section "Project Record Documents."
- D. Examine design data, including HVAC system descriptions, statements of design assumptions for environmental conditions and systems' output, and statements of philosophies and assumptions about HVAC system and equipment controls.
- E. Examine equipment performance data including fan and pump curves. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system. Calculate system effect factors to reduce performance ratings of HVAC equipment when installed under conditions different from those presented when the equipment was performance tested at the factory. To calculate system effects for air systems, use tables and charts found in AMCA 201, "Fans and Systems," Sections 7 through 10; or in SMACNA's "HVAC Systems--Duct Design," Sections 5 and 6. Compare this data with the design data and installed conditions.
- F. Examine system and equipment installations to verify that they are complete and that testing, cleaning, adjusting, and commissioning specified in individual Sections have been performed.
- G. Examine system and equipment test reports.
- H. Examine HVAC system and equipment installations to verify that indicated balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers, are properly installed, and that their locations are accessible and appropriate for effective balancing and for efficient system and equipment operation.
- I. Examine systems for functional deficiencies that cannot be corrected by adjusting and balancing.
- J. Examine HVAC equipment to ensure that clean filters have been installed, bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.
- K. Examine strainers for clean screens and proper perforations.
- L. Examine three-way valves for proper installation for their intended function of diverting or mixing fluid flows.

- M. Examine heat-transfer coils for correct piping connections and for clean and straight fins.
- N. Examine equipment for installation and for properly operating safety interlocks and controls.
- O. Examine automatic temperature system components to verify the following:
 - 1. Dampers, valves, and other controlled devices are operated by the intended controller.
 - 2. Dampers and valves are in the position indicated by the controller.
 - 3. Integrity of valves and dampers for free and full operation and for tightness of fully closed and fully open positions.
 - 4. Automatic modulating and shutoff valves, including two-way valves and three-way mixing and diverting valves, are properly connected.
 - 5. Thermostats and humidistats are located to avoid adverse effects of sunlight, drafts, and cold walls.
 - 6. Sensors are located to sense only the intended conditions.
 - 7. Sequence of operation for control modes is according to the Contract Documents.
 - 8. Controller set points are set at indicated values.
 - 9. Interlocked systems are operating.
 - 10. Changeover from heating to cooling mode occurs according to indicated values.
- P. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

3.2 PREPARATION

- A. Prepare a TAB plan that includes strategies and step-by-step procedures.
- B. Complete system readiness checks and prepare system readiness reports. Verify the following:
 - 1. Permanent electrical power wiring is complete.
 - 2. Automatic temperature-control systems are operational.
 - 3. Equipment and duct access doors are securely closed.
 - 4. Balance, smoke, and fire dampers are open.
 - 5. Isolating and balancing valves are open and control valves are operational.
 - 6. Ceilings are installed in critical areas where air-pattern adjustments are required and access to balancing devices is provided.
 - 7. Windows and doors can be closed so indicated conditions for system operations can be met.

3.3 GENERAL PROCEDURES FOR TESTING AND BALANCING

- A. Perform testing and balancing procedures on each system according to the procedures contained in [AABC's "National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems"] [NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems"] [SMACNA's "HVAC Systems - Testing, Adjusting, and Balancing"] and this Section.
- B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary to allow adequate performance of procedures. After testing and balancing, close probe holes and patch insulation with new materials identical to those removed. Restore vapor barrier and finish according to insulation Specifications for this Project.
- C. Mark equipment and balancing device settings with paint or other suitable, permanent identification material, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, to show final settings.

3.4 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

- A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Crosscheck the summation of required outlet volumes with required fan volumes.
- B. Prepare schematic diagrams of systems' "as-built" duct layouts.
- C. Determine the best locations in main and branch ducts for accurate duct airflow measurements.
- D. Check airflow patterns from the outside-air louvers and dampers and the return- and exhaust-air dampers, through the supply-fan discharge and mixing dampers.
- E. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.
- F. Verify that motor starters are equipped with properly sized thermal protection.
- G. Check dampers for proper position to achieve desired airflow path.
- H. Check for airflow blockages.
- I. Check condensate drains for proper connections and functioning.
- J. Check for proper sealing of air-handling unit components.
- K. Check for proper sealing of air duct system.

3.5 PROCEDURES FOR CONSTANT-VOLUME AIR SYSTEMS

- A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.
 - 1. Measure fan static pressures to determine actual static pressure as follows:
 - a. Measure outlet static pressure as far downstream from the fan as practicable and upstream from restrictions in ducts such as elbows and transitions.
 - b. Measure static pressure directly at the fan outlet or through the flexible connection.
 - c. Measure inlet static pressure of single-inlet fans in the inlet duct as near the fan as possible, upstream from flexible connection and downstream from duct restrictions.
 - d. Measure inlet static pressure of double-inlet fans through the wall of the plenum that houses the fan.
 - 2. Measure static pressure across each component that makes up an air-handling unit, rooftop unit, and other air-handling and -treating equipment.
 - a. Simulate dirty filter operation and record the point at which maintenance personnel must change filters.
 - 3. Measure static pressures entering and leaving other devices such as sound traps, heat recovery equipment, and air washers, under final balanced conditions.
 - 4. Compare design data with installed conditions to determine variations in design static pressures versus actual static pressures. Compare actual system effect factors with calculated system effect factors to identify where variations occur. Recommend corrective action to align design and actual conditions.
 - 5. Obtain approval from Architect for adjustment of fan speed higher or lower than indicated speed. Make required adjustments to pulley sizes, motor sizes, and electrical connections to accommodate fan-speed changes.
 - 6. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure that no overload will occur. Measure amperage in full cooling, full heating, economizer, and any other operating modes to determine the maximum required brake horsepower.
- B. Adjust volume dampers for main duct, submain ducts, and major branch ducts to indicated airflows within specified tolerances.
 - 1. Measure static pressure at a point downstream from the balancing damper and adjust volume dampers until the proper static pressure is achieved.
 - a. Where sufficient space in submain and branch ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow for that zone.

2. Remeasure each submain and branch duct after all have been adjusted. Continue to adjust submain and branch ducts to indicated airflows within specified tolerances.
- C. Measure terminal outlets and inlets without making adjustments.
1. Measure terminal outlets using a direct-reading hood or outlet manufacturer's written instructions and calculating factors.
- D. Adjust terminal outlets and inlets for each space to indicated airflows within specified tolerances of indicated values. Make adjustments using volume dampers rather than extractors and the dampers at air terminals.
1. Adjust each outlet in same room or space to within specified tolerances of indicated quantities without generating noise levels above the limitations prescribed by the Contract Documents.
 2. Adjust patterns of adjustable outlets for proper distribution without drafts.

3.6 PROCEDURES FOR MOTORS

- A. Motors, 1/2 HP and Larger: Test at final balanced conditions and record the following data:
1. Manufacturer, model, and serial numbers.
 2. Motor horsepower rating.
 3. Motor rpm.
 4. Efficiency rating.
 5. Nameplate and measured voltage, each phase.
 6. Nameplate and measured amperage, each phase.
 7. Starter thermal-protection-element rating.
- B. Motors Driven by Variable-Frequency Controllers: Test for proper operation at speeds varying from minimum to maximum. Test the manual bypass for the controller to prove proper operation. Record observations, including controller manufacturer, model and serial numbers, and nameplate data.

3.7 PROCEDURES FOR CONDENSING UNITS

- A. Verify proper rotation of fans.
- B. Measure entering- and leaving-air temperatures.
- C. Record compressor data.

3.8 PROCEDURES FOR HEAT-TRANSFER COILS

- A. Electric-Heating Coils: Measure the following data for each coil:

1. Nameplate data.
2. Airflow.
3. Entering- and leaving-air temperature at full load.
4. Voltage and amperage input of each phase at full load and at each incremental stage.
5. Calculated kilowatt at full load.
6. Fuse or circuit-breaker rating for overload protection.

B. Refrigerant Coils: Measure the following data for each coil:

1. Dry-bulb temperature of entering and leaving air.
2. Wet-bulb temperature of entering and leaving air.
3. Airflow.
4. Air pressure drop.
5. Refrigerant suction pressure and temperature.

3.9 PROCEDURES FOR TEMPERATURE MEASUREMENTS

- A. During TAB, report the need for adjustment in temperature regulation within the automatic temperature-control system.
- B. Measure indoor wet- and dry-bulb temperatures every other hour for a period of two successive eight-hour days, in each separately controlled zone, to prove correctness of final temperature settings. Measure when the building or zone is occupied.
- C. Measure outside-air, wet- and dry-bulb temperatures.

3.10 PROCEDURES FOR TESTING, ADJUSTING, AND BALANCING EXISTING SYSTEMS

- A. Perform a preconstruction inspection of existing equipment that is to remain and be reused.
 1. Measure and record the operating speed, airflow, and static pressure of each fan.
 2. Measure motor voltage and amperage. Compare the values to motor nameplate information.
 3. Check the refrigerant charge.
 4. Check the condition of filters.
 5. Check the condition of coils.
 6. Check the operation of the drain pan and condensate drain trap.
 7. Check bearings and other lubricated parts for proper lubrication.
 8. Report on the operating condition of the equipment and the results of the measurements taken. Report deficiencies.
- B. Before performing testing and balancing of existing systems, inspect existing equipment that is to remain and be reused to verify that existing equipment has been cleaned and refurbished.

1. New filters are installed.
 2. Coils are clean and fins combed.
 3. Drain pans are clean.
 4. Fans are clean.
 5. Bearings and other parts are properly lubricated.
 6. Deficiencies noted in the preconstruction report are corrected.
- C. Perform testing and balancing of existing systems to the extent that existing systems are affected by the renovation work.
1. Compare the indicated airflow of the renovated work to the measured fan airflows and determine the new fan, speed, filter, and coil face velocity.
 2. Verify that the indicated airflows of the renovated work result in filter and coil face velocities and fan speeds that are within the acceptable limits defined by equipment manufacturer.
 3. If calculations increase or decrease the airflow and water flow rates by more than 5 percent, make equipment adjustments to achieve the calculated airflow and water flow rates. If 5 percent or less, equipment adjustments are not required.
 4. Air balance each air outlet.

3.11 TEMPERATURE-CONTROL VERIFICATION

- A. Verify that controllers are calibrated and commissioned.
- B. Check transmitter and controller locations and note conditions that would adversely affect control functions.
- C. Record controller settings and note variances between set points and actual measurements.
- D. Check the operation of limiting controllers (i.e., high- and low-temperature controllers).
- E. Check free travel and proper operation of control devices such as damper and valve operators.
- F. Check the sequence of operation of control devices. Note air pressures and device positions and correlate with airflow and water flow measurements. Note the speed of response to input changes.
- G. Check the interaction of electrically operated switch transducers.
- H. Check the interaction of interlock and lockout systems.
- I. Check main control supply-air pressure and observe compressor and dryer operations.
- J. Record voltages of power supply and controller output. Determine whether the system operates on a grounded or nongrounded power supply.
- K. Note operation of electric actuators using spring return for proper fail-safe operations.

3.12 TOLERANCES

- A. Set HVAC system airflow and water flow rates within the following tolerances:
 - 1. Supply, Return, and Exhaust Fans and Equipment with Fans: Plus 5 to plus 10 percent.
 - 2. Air Outlets and Inlets: 0 to minus 10 percent.
 - 3. Heating-Water Flow Rate: 0 to minus 10 percent.
 - 4. Cooling-Water Flow Rate: 0 to minus 5 percent.

3.13 FINAL REPORT

- A. General: Typewritten, or computer printout in letter-quality font, on standard bond paper, in three-ring binder, tabulated and divided into sections by tested and balanced systems.
- B. Include a certification sheet in front of binder signed and sealed by the certified testing and balancing engineer.
 - 1. Include a list of instruments used for procedures, along with proof of calibration.
- C. Final Report Contents: In addition to certified field report data, include the following:
 - 1. Fan curves.
 - 2. Manufacturers' test data.
 - 3. Field test reports prepared by system and equipment installers.
 - 4. Other information relative to equipment performance, but do not include Shop Drawings and Product Data.
- D. General Report Data: In addition to form titles and entries, include the following data in the final report, as applicable:
 - 1. Title page.
 - 2. Name and address of TAB firm.
 - 3. Project name.
 - 4. Project location.
 - 5. Architect's name and address.
 - 6. Engineer's name and address.
 - 7. Contractor's name and address.
 - 8. Report date.
 - 9. Signature of TAB firm who certifies the report.
 - 10. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
 - 11. Summary of contents including the following:
 - a. Indicated versus final performance.
 - b. Notable characteristics of systems.
 - c. Description of system operation sequence if it varies from the Contract Documents.

12. Nomenclature sheets for each item of equipment.
 13. Data for terminal units, including manufacturer, type size, and fittings.
 14. Notes to explain why certain final data in the body of reports varies from indicated values.
 15. Test conditions for fans and pump performance forms including the following:
 - a. Settings for outside-, return-, and exhaust-air dampers.
 - b. Conditions of filters.
 - c. Cooling coil, wet- and dry-bulb conditions.
 - d. Face and bypass damper settings at coils.
 - e. Fan drive settings including settings and percentage of maximum pitch diameter.
 - f. Inlet vane settings for variable-air-volume systems.
 - g. Settings for supply-air, static-pressure controller.
 - h. Other system operating conditions that affect performance.
- E. System Diagrams: Include schematic layouts of air and hydronic distribution systems. Present each system with single-line diagram and include the following:
1. Quantities of outside, supply, return, and exhaust airflows.
 2. Water and steam flow rates.
 3. Duct, outlet, and inlet sizes.
 4. Pipe and valve sizes and locations.
 5. Terminal units.
 6. Balancing stations.
 7. Position of balancing devices.

3.14 ADDITIONAL TESTS

- A. Within 90 days of completing TAB, perform additional testing and balancing to verify that balanced conditions are being maintained throughout and to correct unusual conditions.
- B. Seasonal Periods: If initial TAB procedures were not performed during near-peak summer and winter conditions, perform additional testing, inspecting, and adjusting during near-peak summer and winter conditions.

END OF SECTION

SECTION 233113 - METAL DUCTS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes metal, rectangular ducts and fittings for supply, return, outside, and exhaust air-distribution systems in pressure classes from **minus 2- to plus 10-inch wg (minus 500 to plus 2500 Pa)**.
- B. See Division 23 Section "Nonmetal Ducts" for fibrous-glass ducts.
- C. See Division 23 Section "Air Duct Accessories" for dampers, sound-control devices, duct-mounting access doors and panels, turning vanes, and flexible ducts.

1.2 SUBMITTALS

- A. Shop Drawings: Show fabrication and installation details for metal ducts.
 - 1. Penetrations through fire-rated and other partitions.
 - 2. Duct accessories, including access doors and panels.

1.3 QUALITY ASSURANCE

- A. NFPA Compliance:
 - 1. NFPA 90A, "Installation of Air Conditioning and Ventilating Systems."
 - 2. NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."

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. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.
 - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 SHEET METAL MATERIALS

- A. Comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods, unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.
- B. Galvanized Sheet Steel: Lock-forming quality; complying with ASTM A 653/A 653M and having G90 (Z275) coating designation; ducts shall have mill-phosphatized finish for surfaces exposed to view.
- C. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts.
- D. Tie Rods: Galvanized steel, 1/4-inch (6-mm) minimum diameter for lengths 36 inches (900 mm) or less; 3/8-inch (10-mm) minimum diameter for lengths longer than 36 inches (900 mm).

2.3 SEALANT MATERIALS

- A. Joint and Seam Tape: 2 inches (50 mm) wide; glass-fiber-reinforced fabric.
- B. Tape Sealing System: Woven-fiber tape impregnated with gypsum mineral compound and modified acrylic/silicone activator to react exothermically with tape to form hard, durable, airtight seal.
- C. Water-Based Joint and Seam Sealant: Flexible, adhesive sealant, resistant to UV light when cured, UL 723 listed, and complying with NFPA requirements for Class 1 ducts.
- D. Solvent-Based Joint and Seam Sealant: One-part, nonsag, solvent-release-curing, polymerized butyl sealant formulated with a minimum of 75 percent solids.
- E. Flanged Joint Mastic: One-part, acid-curing, silicone, elastomeric joint sealant complying with ASTM C 920, Type S, Grade NS, Class 25, Use O.
- F. Flange Gaskets: Butyl rubber or EPDM polymer with polyisobutylene plasticizer.

2.4 HANGERS AND SUPPORTS

- A. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.
 - 1. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches (100 mm) thick.
 - 2. Exception: Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches (100 mm) thick.
- B. Hanger Materials: Galvanized sheet steel or threaded steel rod.

1. Hangers Installed in Corrosive Atmospheres: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.
 2. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for steel sheet width and thickness and for steel rod diameters.
- C. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.
- D. Trapeze and Riser Supports: Galvanized-steel shapes and plates complying with ASTM A 36/A 36M.

2.5 RECTANGULAR DUCT FABRICATION

- A. Fabricate ducts, elbows, transitions, offsets, branch connections, and other construction according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" and complying with requirements for metal thickness, reinforcing types and intervals, tie-rod applications, and joint types and intervals.
1. Lengths: Fabricate rectangular ducts in lengths appropriate to reinforcement and rigidity class required for pressure class.
 2. Deflection: Duct systems shall not exceed deflection limits according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible."
- B. Transverse Joints: Prefabricated slide-on joints and components constructed using manufacturer's guidelines for material thickness, reinforcement size and spacing, and joint reinforcement.
1. Available Manufacturers:
 - a. Ductmate Industries, Inc.
 - b. Nexus Inc.
 - c. Ward Industries, Inc.
- C. Formed-On Flanges: Construct according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible," Figure 1-4, using corner, bolt, cleat, and gasket details.
1. Available Manufacturers:
 - a. Ductmate Industries, Inc.
 - b. Lockformer.
 - c. Approved equal.
 2. Duct Size: Maximum **30 inches (750 mm)** wide and up to **2-inch wg (500-Pa)** pressure class.
 3. Longitudinal Seams: Pittsburgh lock sealed with noncuring polymer sealant.

- D. Cross Breaking or Cross Beading: Cross break or cross bead duct sides **19 inches (480 mm)** and larger and **0.0359 inch (0.9 mm)** thick or less, with more than **10 sq. ft. (0.93 sq. m)** of nonbraced panel area unless ducts are lined.

PART 3 - EXECUTION

3.1 DUCT APPLICATIONS

- A. Static-Pressure Classes: Unless otherwise indicated, construct ducts according to the following:
 - 1. Supply Ducts: **1-inch wg (250 Pa)**.
 - 2. Supply Ducts (before Air Terminal Units): **2-inch wg (500 Pa)**.
 - 3. Supply Ducts (after Air Terminal Units): **1-inch wg (250 Pa)**.
 - 4. Supply Ducts (in Mechanical Equipment Rooms): **2-inch wg (500 Pa)**.
 - 5. Return Ducts (Negative Pressure): **1/2-inch wg (125 Pa)**.
 - 6. Exhaust Ducts (Negative Pressure): **1-inch wg (250 Pa)**.

3.2 DUCT INSTALLATION

- A. Construct and install ducts according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible," unless otherwise indicated.
- B. Install ducts with fewest possible joints.
- C. Install fabricated fittings for changes in directions, size, and shape and for connections.
- D. Install couplings tight to duct wall surface with a minimum of projections into duct. Secure couplings with sheet metal screws. Install screws at intervals of **12 inches (300 mm)**, with a minimum of 3 screws in each coupling.
- E. Install ducts, unless otherwise indicated, vertically and horizontally and parallel and perpendicular to building lines; avoid diagonal runs.
- F. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.
- G. Install ducts with a clearance of **1 inch (25 mm)**, plus allowance for insulation thickness.
- H. Conceal ducts from view in finished spaces. Do not encase horizontal runs in solid partitions unless specifically indicated.
- I. Coordinate layout with suspended ceiling, fire- and smoke-control dampers, lighting layouts, and similar finished work.
- J. Seal all joints and seams. Apply sealant to male end connectors before insertion, and afterward to cover entire joint and sheet metal screws.

- K. Electrical Equipment Spaces: Route ducts to avoid passing through transformer vaults and electrical equipment spaces and enclosures.
- L. Non-Fire-Rated Partition Penetrations: Where ducts pass through interior partitions and exterior walls and are exposed to view, conceal spaces between construction openings and ducts or duct insulation with sheet metal flanges of same metal thickness as ducts. Overlap openings on 4 sides by at least **1-1/2 inches (38 mm)**.
- M. Fire-Rated Partition Penetrations: Where ducts pass through interior partitions and exterior walls, install appropriately rated fire dampers, sleeves, and firestopping sealant. Fire and smoke dampers are specified in Division 23 Section "Air Duct Accessories." Firestopping materials and installation methods are specified in Division 07 Section "Penetration Firestopping."
- N. Protect duct interiors from the elements and foreign materials until building is enclosed. Follow SMACNA's "Duct Cleanliness for New Construction."

3.3 SEAM AND JOINT SEALING

- A. Seal duct seams and joints according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for duct pressure class indicated.
 - 1. For pressure classes lower than **2-inch wg (500 Pa)**, seal transverse joints.
- B. Seal ducts before external insulation is applied.

3.4 HANGING AND SUPPORTING

- A. Support horizontal ducts within **24 inches (600 mm)** of each elbow and within **48 inches (1200 mm)** of each branch intersection.
- B. Support vertical ducts at maximum intervals of **16 feet (5 m)** and at each floor.
- C. Install upper attachments to structures with an allowable load not exceeding one-fourth of failure (proof-test) load.
- D. Install concrete inserts before placing concrete.
- E. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
 - 1. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than **4 inches (100 mm)** thick.

3.5 CONNECTIONS

- A. Make connections to equipment with flexible connectors according to Division 23 Section "Air Duct Accessories."

- B. Comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

END OF SECTION

SECTION 233300 - AIR DUCT ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Backdraft and pressure relief dampers.
 - 2. Manual volume dampers.
 - 3. Control dampers.
 - 4. Fire dampers.
 - 5. Smoke dampers.
 - 6. Flange connectors.
 - 7. Turning vanes.
 - 8. Duct-mounted access doors.
 - 9. Flexible connectors.
 - 10. Flexible ducts.
 - 11. Duct accessory hardware.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For duct accessories. Include plans, elevations, sections, details and attachments to other work.
 - 1. Detail duct accessories fabrication and installation in ducts and other construction. Include dimensions, weights, loads, and required clearances; and method of field assembly into duct systems and other construction. Include the following:
 - a. Special fittings.
 - b. Manual volume damper installations.
 - c. Control damper installations.
 - d. Fire-damper and smoke-damper installations, including sleeves; and duct-mounted access doors.
 - e. Wiring Diagrams: For power, signal, and control wiring.
- C. Operation and maintenance data.

1.3 QUALITY ASSURANCE

- A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and with NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."
- B. Comply with AMCA 500-D testing for damper rating.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.
- B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.
 - 1. Galvanized Coating Designation: **G90 (Z275)**.
 - 2. Exposed-Surface Finish: Mill phosphatized.
- C. Aluminum Sheets: Comply with **ASTM B 209 (ASTM B 209M)**, Alloy 3003, Temper H14; with mill finish for concealed ducts and standard, 1-side bright finish for exposed ducts.
- D. Extruded Aluminum: Comply with **ASTM B 221 (ASTM B 221M)**, Alloy 6063, Temper T6.
- E. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.
- F. Tie Rods: Galvanized steel, **1/4-inch (6-mm)** minimum diameter for lengths **36 inches (900 mm)** or less; **3/8-inch (10-mm)** minimum diameter for lengths longer than **36 inches (900 mm)**.

2.2 BACKDRAFT AND PRESSURE RELIEF DAMPERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Air Balance Inc.; a division of Mestek, Inc.
 - 2. American Warming and Ventilating; a division of Mestek, Inc.
 - 3. Cesco Products; a division of Mestek, Inc.
 - 4. Duro Dyne Inc.
 - 5. Greenheck Fan Corporation.
 - 6. Lloyd Industries, Inc.
 - 7. Nailor Industries Inc.
 - 8. NCA Manufacturing, Inc.
 - 9. Pottorff; a division of PCI Industries, Inc.
 - 10. Ruskin Company.
 - 11. SEMCO Incorporated.
 - 12. Vent Products Company, Inc.

- B. Description: Gravity balanced.
- C. Maximum Air Velocity: 2000 fpm (10 m/s).
- D. Maximum System Pressure: 1-inch wg (0.25 kPa).
- E. Frame: 0.052-inch- (1.3-mm-) thick, galvanized sheet steel [0.052-inch- (1.3-mm-) thick stainless steel], with welded corners[and mounting flange].

2.3 MANUAL VOLUME DAMPERS

A. Standard, Steel, Manual Volume Dampers:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Air Balance Inc.; a division of Mestek, Inc.
 - b. American Warming and Ventilating; a division of Mestek, Inc.
 - c. Flexmaster U.S.A., Inc.
 - d. McGill AirFlow LLC.
 - e. METALAIRE, Inc.
 - f. Nailor Industries Inc.
 - g. Pottorff; a division of PCI Industries, Inc.
 - h. Ruskin Company.
 - i. Trox USA Inc.
 - j. Vent Products Company, Inc.
2. Standard leakage rating, with linkage outside airstream.
3. Suitable for horizontal or vertical applications.
4. Frames:
 - a. Hat-shaped, galvanized-steel channels, 0.064-inch (1.62-mm) minimum thickness.
 - b. Mitered and welded corners.
 - c. Flanges for attaching to walls and flangeless frames for installing in ducts.
5. Blades:
 - a. Multiple or single blade.
 - b. Parallel- or opposed-blade design.
 - c. Stiffen damper blades for stability.
 - d. Galvanized-steel, 0.064 inch (1.62 mm) thick.
6. Blade Axles: Galvanized steel.
7. Bearings:
 - a. Stainless-steel sleeve.

- b. Dampers in ducts with pressure classes of **3-inch wg (750 Pa)** or less shall have axles full length of damper blades and bearings at both ends of operating shaft.
 8. Tie Bars and Brackets: Galvanized steel.
- B. Standard, Aluminum, Manual Volume Dampers:
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Air Balance Inc.; a division of Mestek, Inc.
 - b. American Warming and Ventilating; a division of Mestek, Inc.
 - c. Flexmaster U.S.A., Inc.
 - d. McGill AirFlow LLC.
 - e. METALAIRE, Inc.
 - f. Nailor Industries Inc.
 - g. Pottorff; a division of PCI Industries, Inc.
 - h. Ruskin Company.
 - i. Trox USA Inc.
 - j. Vent Products Company, Inc.
 2. Standard leakage rating, with linkage outside airstream.
 3. Suitable for horizontal or vertical applications.
 4. Frames: Hat-shaped, **0.10-inch- (2.5-mm-)** thick, aluminum sheet channels; frames with flanges for attaching to walls and flangeless frames for installing in ducts.
 5. Blades:
 - a. Multiple or single blade.
 - b. Parallel- or opposed-blade design.
 - c. Stiffen damper blades for stability.
 - d. Roll-Formed Aluminum Blades: **0.10-inch- (2.5-mm-)** thick aluminum sheet.
 - e. Extruded-Aluminum Blades: **0.050-inch- (1.2-mm-)** thick extruded aluminum.
 6. Blade Axles: Galvanized steel.
 7. Bearings:
 - a. Stainless-steel sleeve.
 - b. Dampers in ducts with pressure classes of **3-inch wg (750 Pa)** or less shall have axles full length of damper blades and bearings at both ends of operating shaft.
 8. Tie Bars and Brackets: Aluminum.
- C. Jackshaft:

1. Size: 1-inch (25-mm) diameter.
2. Material: Galvanized-steel pipe rotating within pipe-bearing assembly mounted on supports at each mullion and at each end of multiple-damper assemblies.
3. Length and Number of Mountings: As required to connect linkage of each damper in multiple-damper assembly.

D. Damper Hardware:

1. Zinc-plated, die-cast core with dial and handle made of 3/32-inch- (2.4-mm-) thick zinc-plated steel, and a 3/4-inch (19-mm) hexagon locking nut.
2. Include center hole to suit damper operating-rod size.
3. Include elevated platform for insulated duct mounting.

2.4 CONTROL DAMPERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. American Warming and Ventilating; a division of Mestek, Inc.
2. Arrow United Industries; a division of Mestek, Inc.
3. Cesco Products; a division of Mestek, Inc.
4. Duro Dyne Inc.
5. Flexmaster U.S.A., Inc.
6. Greenheck Fan Corporation.
7. Lloyd Industries, Inc.
8. M&I Air Systems Engineering; Division of M&I Heat Transfer Products Ltd.
9. McGill AirFlow LLC.
10. METALAIRE, Inc.
11. Metal Form Manufacturing, Inc.
12. Nailor Industries Inc.
13. NCA Manufacturing, Inc.
14. Ruskin Company.
15. Vent Products Company, Inc.
16. Young Regulator Company.

B. Frames:

1. Angle shaped.
2. Galvanized-steel channels, 0.064 inch (1.62 mm) thick.
3. Mitered and welded corners.

C. Blades:

1. Multiple blade with maximum blade width of 8 inches (200 mm).
2. Parallel- and opposed-blade design.
3. Galvanized steel.
4. 0.064 inch (1.62 mm) thick.

5. Blade Edging: Closed-cell neoprene edging.
 6. Blade Edging: Inflatable seal blade edging, or replaceable rubber seals.
- D. Blade Axles: **1/2-inch- (13-mm-)** diameter; galvanized steel; blade-linkage hardware of zinc-plated steel and brass; ends sealed against blade bearings.
1. Operating Temperature Range: From **minus 40 to plus 200 deg F (minus 40 to plus 93 deg C)**.
- E. Bearings:
1. Stainless-steel sleeve.
 2. Dampers in ducts with pressure classes of **3-inch wg (750 Pa)** or less shall have axles full length of damper blades and bearings at both ends of operating shaft.
 3. Thrust bearings at each end of every blade.

2.5 FIRE DAMPERS

- 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. Air Balance Inc.; a division of Mestek, Inc.
 2. Arrow United Industries; a division of Mestek, Inc.
 3. Cesco Products; a division of Mestek, Inc.
 4. Greenheck Fan Corporation.
 5. McGill AirFlow LLC.
 6. METALAIRE, Inc.
 7. Nailor Industries Inc.
 8. NCA Manufacturing, Inc.
 9. PHL, Inc.
 10. Pottorff; a division of PCI Industries, Inc.
 11. Prefco; Perfect Air Control, Inc.
 12. Ruskin Company.
 13. Vent Products Company, Inc.
 14. Ward Industries, Inc.; a division of Hart & Cooley, Inc.
- B. Type: Static and dynamic; rated and labeled according to UL 555 by an NRTL.
- C. Closing rating in ducts up to **4-inch wg (1-kPa)** static pressure class and minimum **4000-fpm (20-m/s)** velocity.
- D. Fire Rating: 1-1/2 hours.
- E. Frame: Curtain type with blades inside airstream Curtain type with blades outside airstream Multiple-blade type Curtain type with blades outside airstream except when located behind grille where blades may be inside airstream; fabricated with roll-formed, **0.034-inch- (0.85-mm-)** thick galvanized steel; with mitered and interlocking corners.

- F. Mounting Sleeve: Factory- or field-installed, galvanized sheet steel.
 - 1. Minimum Thickness: 0.052 or 0.138 inch (1.3 or 3.5 mm) thick, as indicated, and of length to suit application.
 - 2. Exception: Omit sleeve where damper-frame width permits direct attachment of perimeter mounting angles on each side of wall or floor; thickness of damper frame must comply with sleeve requirements.
- G. Mounting Orientation: Vertical or horizontal as indicated.
- H. Blades: Roll-formed, interlocking, 0.034-inch- (0.85-mm-) thick, galvanized sheet steel. In place of interlocking blades, use full-length, 0.034-inch- (0.85-mm-) thick, galvanized-steel blade connectors.
- I. Horizontal Dampers: Include blade lock and stainless-steel closure spring.
- J. Heat-Responsive Device: Replaceable, 212 deg F (100 deg C) rated, fusible links.
- K. Heat-Responsive Device: Pneumatic resettable link and switch package, factory installed, 165 deg F (74 deg C) and rated.

2.6 SMOKE DAMPERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Air Balance Inc.; a division of Mestek, Inc.
 - 2. Cesco Products; a division of Mestek, Inc.
 - 3. Greenheck Fan Corporation.
 - 4. Nailor Industries Inc.
 - 5. PHL, Inc.
 - 6. Ruskin Company.
- B. General Requirements: Label according to UL 555S by an NRTL.
- C. Smoke Detector: Integral, factory wired for single-point connection.
- D. Frame: Curtain type with blades inside airstream Curtain type with blades outside airstream Multiple-blade type Curtain type with blades outside airstream except when located behind grille where blades may be inside airstream; fabricated with roll-formed, 0.034-inch- (0.85-mm-) thick galvanized steel; with mitered and interlocking corners.
- E. Blades: Roll-formed, horizontal, interlocking, 0.034-inch- (0.85-mm-) thick, galvanized sheet steel. In place of interlocking blades, use full-length, 0.034-inch- (0.85-mm-) thick, galvanized-steel blade connectors.
- F. Leakage: Class I Class II <Insert class>.
- G. Rated pressure and velocity to exceed design airflow conditions.

- H. Mounting Sleeve: Factory-installed, 0.052-inch- (1.3-mm-) thick, galvanized sheet steel; length to suit wall or floor application with factory-furnished silicone caulking.
- I. Damper Motors: Modulating or two-position action.
- J. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors.
 - 1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
 - 2. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in Division 23 Section "Instrumentation and Control for HVAC."
 - 3. Permanent-Split-Capacitor or Shaded-Pole Motors: With oil-immersed and sealed gear trains.
 - 4. Spring-Return Motors: Equip with an integral spiral-spring mechanism where indicated. Enclose entire spring mechanism in a removable housing designed for service or adjustments. Size for running torque rating of 150 in. x lbf (17 N x m) and breakaway torque rating of 150 in. x lbf (17 N x m).
 - 5. Outdoor Motors and Motors in Outdoor-Air Intakes: Equip with O-ring gaskets designed to make motors weatherproof. Equip motors with internal heaters to permit normal operation at minus 40 deg F (minus 40 deg C).
 - 6. Nonspring-Return Motors: For dampers larger than 25 sq. ft. (2.3 sq. m), size motor for running torque rating of 150 in. x lbf (17 N x m) and breakaway torque rating of 300 in. x lbf (34 N x m).
 - 7. Electrical Connection: 115 V, single phase, 60 Hz.
- K. Accessories:
 - 1. Auxiliary switches for fan control or position indication.
 - 2. , damper remote mounted.

2.7 FLANGE CONNECTORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Ductmate Industries, Inc.
 - 2. Nexus PDQ; Division of Shilco Holdings Inc.
 - 3. Ward Industries, Inc.; a division of Hart & Cooley, Inc.
- B. Description: Add-on or roll-formed, factory-fabricated, slide-on transverse flange connectors, gaskets, and components.
- C. Material: Galvanized steel.
- D. Gage and Shape: Match connecting ductwork.

2.8 TURNING VANES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Ductmate Industries, Inc.
 2. Duro Dyne Inc.
 3. METALAIRE, Inc.
 4. SEMCO Incorporated.
 5. Ward Industries, Inc.; a division of Hart & Cooley, Inc.
- B. Turning Vanes for Metal Ducts: Curved blades of galvanized sheet steel; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.
1. Acoustic Turning Vanes: Fabricate airfoil-shaped aluminum extrusions with perforated faces and fibrous-glass fill.
- C. Manufactured Turning Vanes for Nonmetal Ducts: Fabricate curved blades of resin-bonded fiberglass with acrylic polymer coating; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.
- D. General Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 2-3, "Vaness and Vane Runners," and 2-4, "Vane Support in Elbows."
- E. Vane Construction: Single wall.
- F. Vane Construction: Single wall for ducts up to 48 inches (1200 mm) wide and double wall for larger dimensions.

2.9 DUCT-MOUNTED ACCESS DOORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. American Warming and Ventilating; a division of Mestek, Inc.
 2. Cesco Products; a division of Mestek, Inc.
 3. Ductmate Industries, Inc.
 4. Flexmaster U.S.A., Inc.
 5. Greenheck Fan Corporation.
 6. McGill AirFlow LLC.
 7. Nailor Industries Inc.
 8. Pottorff; a division of PCI Industries, Inc.
 9. Ventfabrics, Inc.
 10. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

- B. Duct-Mounted Access Doors: Fabricate access panels according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 2-10, "Duct Access Doors and Panels," and 2-11, "Access Panels - Round Duct."

1. Door:
 - a. Double wall, rectangular.
 - b. Galvanized sheet metal with insulation fill and thickness as indicated for duct pressure class.
 - c. Vision panel.
 - d. Hinges and Latches: 1-by-1-inch (25-by-25-mm) butt or piano hinge and cam latches.
 - e. Fabricate doors airtight and suitable for duct pressure class.
2. Frame: Galvanized sheet steel, with bend-over tabs and foam gaskets.
3. Number of Hinges and Locks:
 - a. Access Doors Less Than 12 Inches (300 mm) Square: No hinges and two sash locks.
 - b. Access Doors up to 18 Inches (460 mm) Square: Two hinges and two sash locks.
 - c. Access Doors up to 24 by 48 Inches (600 by 1200 mm): Three hinges and two compression latches with outside and inside handles.
 - d. Access Doors Larger Than 24 by 48 Inches (600 by 1200 mm): Four hinges and two compression latches with outside and inside handles.

- C. Pressure Relief Access Door:

1. Door and Frame Material: Galvanized sheet steel.
2. Door: Single wall with metal thickness applicable for duct pressure class.
3. Operation: Open outward for positive-pressure ducts and inward for negative-pressure ducts.
4. Factory set at 10-inch wg (2500 Pa).
5. Doors close when pressures are within set-point range.
6. Hinge: Continuous piano.
7. Latches: Cam.
8. Seal: Neoprene or foam rubber.
9. Insulation Fill: 1-inch- (25-mm-) thick, fibrous-glass or polystyrene-foam board.

2.10 DUCT ACCESS PANEL ASSEMBLIES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Ductmate Industries, Inc.
2. Flame Gard, Inc.
3. 3M.

- B. Labeled according to UL 1978 by an NRTL.
- C. Panel and Frame: Minimum thickness 0.0428-inch (1.1-mm) stainless steel.
- D. Fasteners: Stainless steel. Panel fasteners shall not penetrate duct wall.
- E. Gasket: Comply with NFPA 96; grease-tight, high-temperature ceramic fiber, rated for minimum 2000 deg F (1093 deg C).
- F. Minimum Pressure Rating: 10-inch wg (2500 Pa), positive or negative.

2.11 FLEXIBLE CONNECTORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Ductmate Industries, Inc.
 - 2. Duro Dyne Inc.
 - 3. Ventfabrics, Inc.
 - 4. Ward Industries, Inc.; a division of Hart & Cooley, Inc.
- B. Materials: Flame-retardant or noncombustible fabrics.
- C. Coatings and Adhesives: Comply with UL 181, Class 1.
- D. Metal-Edged Connectors: Factory fabricated with a fabric strip 3-1/2 inches (89 mm) wide attached to 2 strips of 2-3/4-inch- (70-mm-) wide, 0.028-inch- (0.7-mm-) thick, galvanized sheet steel or 0.032-inch- (0.8-mm-) thick aluminum sheets. Provide metal compatible with connected ducts.
- E. Indoor System, Flexible Connector Fabric: Glass fabric double coated with neoprene.
 - 1. Minimum Weight: 26 oz./sq. yd. (880 g/sq. m).
 - 2. Tensile Strength: 480 lbf/inch (84 N/mm) in the warp and 360 lbf/inch (63 N/mm) in the filling.
 - 3. Service Temperature: Minus 40 to plus 200 deg F (Minus 40 to plus 93 deg C).
- F. Outdoor System, Flexible Connector Fabric: Glass fabric double coated with weatherproof, synthetic rubber resistant to UV rays and ozone.
 - 1. Minimum Weight: 24 oz./sq. yd. (810 g/sq. m).
 - 2. Tensile Strength: 530 lbf/inch (93 N/mm) in the warp and 440 lbf/inch (77 N/mm) in the filling.
 - 3. Service Temperature: Minus 50 to plus 250 deg F (Minus 45 to plus 121 deg C).
- G. Thrust Limits: Combination coil spring and elastomeric insert with spring and insert in compression, and with a load stop. Include rod and angle-iron brackets for attaching to fan discharge and duct.

1. Frame: Steel, fabricated for connection to threaded rods and to allow for a maximum of 30 degrees of angular rod misalignment without binding or reducing isolation efficiency.
2. Outdoor Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
6. Elastomeric Element: Molded, oil-resistant rubber or neoprene.
7. Coil Spring: Factory set and field adjustable for a maximum of 1/4-inch (6-mm) movement at start and stop.

2.12 FLEXIBLE DUCTS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Flexmaster U.S.A., Inc.
 2. McGill AirFlow LLC.
 3. Ward Industries, Inc.; a division of Hart & Cooley, Inc.
- B. Noninsulated, Flexible Duct: UL 181, Class 1, 2-ply vinyl film supported by helically wound, spring-steel wire.
1. Pressure Rating: 10-inch wg (2500 Pa) positive and 1.0-inch wg (250 Pa) negative.
 2. Maximum Air Velocity: 4000 fpm (20 m/s).
 3. Temperature Range: Minus 10 to plus 160 deg F (Minus 23 to plus 71 deg C).
- C. Noninsulated, Flexible Duct: UL 181, Class 1, black polymer film supported by helically wound, spring-steel wire.
1. Pressure Rating: 4-inch wg (1000 Pa) positive and 0.5-inch wg (125 Pa) negative.
 2. Maximum Air Velocity: 4000 fpm (20 m/s).
 3. Temperature Range: Minus 20 to plus 175 deg F (Minus 29 to plus 79 deg C).
- D. Noninsulated, Flexible Duct: UL 181, Class 1, multiple layers of aluminum laminate supported by helically wound, spring-steel wire.
1. Pressure Rating: 10-inch wg (2500 Pa) positive and 1.0-inch wg (250 Pa) negative.
 2. Maximum Air Velocity: 4000 fpm (20 m/s).
 3. Temperature Range: Minus 20 to plus 210 deg F (Minus 29 to plus 99 deg C).
- E. Noninsulated, Flexible Duct: UL 181, Class 1, aluminum laminate and polyester film with latex adhesive supported by helically wound, spring-steel wire.

1. Pressure Rating: 10-inch wg (2500 Pa) positive and 1.0-inch wg (250 Pa) negative.
 2. Maximum Air Velocity: 4000 fpm (20 m/s).
 3. Temperature Range: Minus 20 to plus 210 deg F (Minus 29 to plus 99 deg C).
- F. Noninsulated, Flexible Duct: UL 181, Class 0, interlocking spiral of aluminum foil.
1. Pressure Rating: 8-inch wg (2280 Pa) positive or negative.
 2. Maximum Air Velocity: 5000 fpm (25 m/s).
 3. Temperature Range: Minus 100 to plus 435 deg F (Minus 73 to plus 224 deg C).
- G. Insulated, Flexible Duct: UL 181, Class 1, 2-ply vinyl film supported by helically wound, spring-steel wire; fibrous-glass insulation; polyethylene vapor-barrier film.
1. Pressure Rating: 10-inch wg (2500 Pa) positive and 1.0-inch wg (250 Pa) negative.
 2. Maximum Air Velocity: 4000 fpm (20 m/s).
 3. Temperature Range: Minus 10 to plus 160 deg F (Minus 23 to plus 71 deg C).
- H. Insulated, Flexible Duct: UL 181, Class 1, black polymer film supported by helically wound, spring-steel wire; fibrous-glass insulation; polyethylene aluminized vapor-barrier film.
1. Pressure Rating: 4-inch wg (1000 Pa) positive and 0.5-inch wg (125 Pa) negative.
 2. Maximum Air Velocity: 4000 fpm (20 m/s).
 3. Temperature Range: Minus 20 to plus 175 deg F (Minus 29 to plus 79 deg C).
- I. Insulated, Flexible Duct: UL 181, Class 1, multiple layers of aluminum laminate supported by helically wound, spring-steel wire; fibrous-glass insulation; polyethylene vapor-barrier film.
1. Pressure Rating: 10-inch wg (2500 Pa) positive and 1.0-inch wg (250 Pa) negative.
 2. Maximum Air Velocity: 4000 fpm (20 m/s).
 3. Temperature Range: Minus 20 to plus 210 deg F (Minus 29 to plus 99 deg C).
- J. Insulated, Flexible Duct: UL 181, Class 1, aluminum laminate and polyester film with latex adhesive supported by helically wound, spring-steel wire; fibrous-glass insulation; polyethylene vapor-barrier film.
1. Pressure Rating: 10-inch wg (2500 Pa) positive and 1.0-inch wg (250 Pa) negative.
 2. Maximum Air Velocity: 4000 fpm (20 m/s).
 3. Temperature Range: Minus 20 to plus 210 deg F (Minus 29 to plus 99 deg C).
- K. Insulated, Flexible Duct: UL 181, Class 0, interlocking spiral of aluminum foil; fibrous-glass insulation; polyethylene vapor-barrier film.
1. Pressure Rating: 8-inch wg (2280 Pa) positive or negative.

2. Maximum Air Velocity: 5000 fpm (25 m/s).
3. Temperature Range: Minus 20 to plus 250 deg F (Minus 29 to plus 121 deg C).

L. Flexible Duct Connectors:

1. Clamps: Nylon strap in sizes 3 through 18 inches (75 through 460 mm), to suit duct size.
2. Non-Clamp Connectors: Adhesive plus sheet metal screws.

2.13 DUCT ACCESSORY HARDWARE

- A. Instrument Test Holes: Cast iron or cast aluminum to suit duct material, including screw cap and gasket. Size to allow insertion of pitot tube and other testing instruments and of length to suit duct-insulation thickness.
- B. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for metal ducts and in NAIMA AH116, "Fibrous Glass Duct Construction Standards," for fibrous-glass ducts.
- B. Install duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel and fibrous-glass ducts, stainless-steel accessories in stainless-steel ducts, and aluminum accessories in aluminum ducts.
- C. Install backdraft dampers at inlet of exhaust fans or exhaust ducts as close as possible to exhaust fan unless otherwise indicated.
- D. Install volume dampers at points on supply, return, and exhaust systems where branches extend from larger ducts. Where dampers are installed in ducts having duct liner, install dampers with hat channels of same depth as liner, and terminate liner with nosing at hat channel.
 1. Install steel volume dampers in steel ducts.
 2. Install aluminum volume dampers in aluminum ducts.
- E. Set dampers to fully open position before testing, adjusting, and balancing.
- F. Install test holes at fan inlets and outlets and elsewhere as indicated.
- G. Install fire and smoke dampers according to UL listing.

- H. Install duct access doors on sides of ducts to allow for inspecting, adjusting, and maintaining accessories and equipment at the following locations:
 - 1. On both sides of duct coils.
 - 2. Downstream from manual volume dampers, control dampers, turning vanes, and equipment.
 - 3. Adjacent to and close enough to fire or smoke dampers, to reset or reinstall fusible links. Access doors for access to fire or smoke dampers having fusible links shall be pressure relief access doors; and shall be outward operation for access doors installed upstream from dampers and inward operation for access doors installed downstream from dampers.
 - 4. At each change in direction and at maximum **50-foot (15-m)** spacing.
 - 5. Upstream of turning vanes.
 - 6. Elsewhere as indicated.
- I. Install access doors with swing against duct static pressure.
- J. Access Door Sizes:
 - 1. One-Hand or Inspection Access: **8 by 5 inches (200 by 125 mm)**.
 - 2. Two-Hand Access: **12 by 6 inches (300 by 150 mm)**.
 - 3. Head and Hand Access: **18 by 10 inches (460 by 250 mm)**.
 - 4. Head and Shoulders Access: **21 by 14 inches (530 by 355 mm)**.
 - 5. Body Access: **25 by 14 inches (635 by 355 mm)**.
 - 6. Body plus Ladder Access: **25 by 17 inches (635 by 430 mm)**.
- K. Install flexible connectors to connect ducts to equipment.
- L. For fans developing static pressures of **5-inch wg (1250 Pa)** and more, cover flexible connectors with loaded vinyl sheet held in place with metal straps.
- M. Connect terminal units to supply ducts directly or with maximum **12-inch (300-mm)** lengths of flexible duct. Do not use flexible ducts to change directions.
- N. Connect diffusers or light troffer boots to low-pressure ducts directly or with maximum **60-inch (1500-mm)** lengths of flexible duct clamped or strapped in place.
- O. Connect flexible ducts to metal ducts with adhesive [liquid adhesive plus tape] draw bands adhesive plus sheet metal screws.
- P. Install duct test holes where required for testing and balancing purposes.
- Q. Install thrust limits at centerline of thrust, symmetrical on both sides of equipment. Attach thrust limits at centerline of thrust and adjust to a maximum of **1/4-inch (6-mm)** movement during start and stop of fans.

3.2 FIELD QUALITY CONTROL

- A. Tests and Inspections:

1. Operate dampers to verify full range of movement.
2. Inspect locations of access doors and verify that purpose of access door can be performed.
3. Operate fire and smoke dampers to verify full range of movement and verify that proper heat-response device is installed.
4. Inspect turning vanes for proper and secure installation.

END OF SECTION

SECTION 233423 - HVAC POWER VENTILATORS

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. In-line centrifugal fans.

1.3 PERFORMANCE REQUIREMENTS

- A. Project Altitude: Base fan-performance ratings on sea level.
- B. Operating Limits: Classify according to AMCA 99.

1.4 SUBMITTALS

- A. Product Data: Include rated capacities, furnished specialties, and accessories for each type of product indicated and include the following:
 - 1. Certified fan performance curves with system operating conditions indicated.
 - 2. Certified fan sound-power ratings.
 - 3. Motor ratings and electrical characteristics, plus motor and electrical accessories.
 - 4. Material thickness and finishes, including color charts.
 - 5. Dampers, including housings, linkages, and operators.
 - 6. Fan speed controllers.
- 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. Wiring Diagrams: Power, signal, and control wiring.
 - 2. Design Calculations: Calculate requirements for selecting vibration isolators .
- C. Coordination Drawings: Reflected ceiling plans and other details, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:
 - 1. Roof framing and support members relative to duct penetrations.
 - 2. Ceiling suspension assembly members.
 - 3. Size and location of initial access modules for acoustical tile.
 - 4. Ceiling-mounted items including light fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.
- D. Field quality-control test reports.

- E. Operation and Maintenance Data: For power ventilators to include in emergency, operation, and maintenance manuals.

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. AMCA Compliance: Products shall comply with performance requirements and shall be licensed to use the AMCA-Certified Ratings Seal.
- C. NEMA Compliance: Motors and electrical accessories shall comply with NEMA standards.
- D. UL Standard: Power ventilators shall comply with UL 705.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver fans as factory-assembled unit, to the extent allowable by shipping limitations, with protective crating and covering.
- B. Disassemble and reassemble units, as required for moving to final location, according to manufacturer's written instructions.
- C. Lift and support units with manufacturer's designated lifting or supporting points.

1.7 COORDINATION

- A. Coordinate size and location of structural-steel support members.

1.8 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. Belts: One set(s) for each belt-driven unit.

PART 2 - PRODUCTS

2.1 IN-LINE CENTRIFUGAL FANS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
 - 1. Greenheck.
 - 2. Loren Cook Company.
 - 3. Penn Ventilation.
- B. Description: In-line, direct-driven centrifugal fans consisting of housing, wheel, outlet guide vanes, fan shaft, bearings, motor and disconnect switch, drive assembly, mounting brackets, and accessories.

- C. Housing: Split, spun aluminum with aluminum straightening vanes, inlet and outlet flanges, and support bracket adaptable to floor, side wall, or ceiling mounting.
- D. Direct-Driven Units: Motor mounted in airstream, factory wired to disconnect switch located on outside of fan housing.
- E. Fan Wheels: Aluminum, airfoil blades welded to aluminum hub.
- F. Accessories:
 - 1. Variable-Speed Controller: Solid-state control to reduce speed from 100 to less than 50 percent.

2.2 MOTORS

- A. Comply with requirements in Division 23 Section "Common Motor Requirements for HVAC Equipment."
- B. Enclosure Type: Totally enclosed, fan cooled.

2.3 SOURCE QUALITY CONTROL

- A. Sound-Power Level Ratings: Comply with AMCA 301, "Methods for Calculating Fan Sound Ratings from Laboratory Test Data." Factory test fans according to AMCA 300, "Reverberant Room Method for Sound Testing of Fans." Label fans with the AMCA-Certified Ratings Seal.
- B. Fan Performance Ratings: Establish flow rate, pressure, power, air density, speed of rotation, and efficiency by factory tests and ratings according to AMCA 210, "Laboratory Methods of Testing Fans for Rating."

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install power ventilators level and plumb.
- B. Ceiling Units: Suspend units from structure; use steel wire or metal straps.
- C. Install units with clearances for service and maintenance.
- D. Label units according to requirements specified in Division 23 Section "Identification for HVAC Piping and Equipment."

3.2 CONNECTIONS

- A. Duct installation and connection requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of ducts and duct accessories. Make final duct connections with flexible connectors. Flexible connectors are specified in Division 23 Section "Air Duct Accessories."
- B. Install ducts adjacent to power ventilators to allow service and maintenance.

- C. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."
- D. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.3 FIELD QUALITY CONTROL

- A. Perform the following field tests and inspections and prepare test reports:
 - 1. Verify that shipping, blocking, and bracing are removed.
 - 2. Verify that unit is secure on mountings and supporting devices and that connections to ducts and electrical components are complete. Verify that proper thermal-overload protection is installed in motors, starters, and disconnect switches.
 - 3. Verify that cleaning and adjusting are complete.
 - 4. Disconnect fan drive from motor, verify proper motor rotation direction, and verify fan wheel free rotation and smooth bearing operation. Reconnect fan drive system, align and adjust belts, and install belt guards.
 - 5. Adjust belt tension.
 - 6. Adjust damper linkages for proper damper operation.
 - 7. Verify lubrication for bearings and other moving parts.
 - 8. Verify that manual and automatic volume control and fire and smoke dampers in connected ductwork systems are in fully open position.
 - 9. Disable automatic temperature-control operators, energize motor and adjust fan to indicated rpm, and measure and record motor voltage and amperage.
 - 10. Shut unit down and reconnect automatic temperature-control operators.
 - 11. Remove and replace malfunctioning units and retest as specified above.
- B. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

3.4 ADJUSTING

- A. Adjust damper linkages for proper damper operation.
- B. Adjust belt tension.
- C. Refer to Division 23 Section "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing procedures.
- D. Replace fan and motor pulleys as required to achieve design airflow.
- E. Lubricate bearings.

END OF SECTION 233423

SECTION 233713 - DIFFUSERS, REGISTERS, AND GRILLES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes ceiling- and wall-mounted diffusers, registers, and grilles.

1.2 SUBMITTALS

- A. Product Data: For each product indicated, include the following:
 - 1. Data Sheet: Indicate materials of construction, finish, and mounting details; and performance data including throw and drop, static-pressure drop, and noise ratings.
 - 2. Diffuser, Register, and Grille Schedule: Indicate Drawing designation, room location, quantity, model number, size, and accessories furnished.

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. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified.
 - 2. Products: Subject to compliance with requirements, provide one of the products specified.
 - 3. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.
 - 4. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 GRILLES AND REGISTERS

- A. Adjustable Bar Grille:
 - 1. Manufacturers:
 - a. A-J Manufacturing Co., Inc.
 - b. Anemostat; a Mestek Company.
 - c. Carnes.
 - d. Dayus Register & Grille.

- e. Hart & Cooley, Inc.; Hart & Cooley Div.
 - f. Krueger.
 - g. METALAIR, Inc.; Metal Industries Inc.
 - h. Nailor Industries of Texas Inc.
 - i. Price Industries.
 - j. Titus.
 - k. Tuttle & Bailey.
 - l. Us Aire
2. Material: Aluminum.
 3. Finish: Baked enamel, color selected by Architect.
 4. Face Blade Arrangement: Adjustable horizontal spaced **1/2 inch (13 mm)** apart.
 5. Rear Blade Arrangement: Adjustable vertical spaced **1/2 inch (13 mm)** apart.
 6. Frame: **1 inch (25 mm)** wide.
 7. Mounting Frame: Filter.
 8. Mounting: Concealed.
 9. Damper Type: Adjustable opposed-blade assembly.
 10. Accessories: Front-blade gang operator.

B. Fixed Face Register:

1. Available Manufacturers:
 - a. A-J Manufacturing Co., Inc.
 - b. Anemostat; a Mestek Company.
 - c. Carnes.
 - d. Dayus Register & Grille.
 - e. Hart & Cooley, Inc.; Hart & Cooley Div.
 - f. Krueger.
 - g. Nailor Industries of Texas Inc.
 - h. Price Industries.
 - i. Titus.
 - j. Tuttle & Bailey.
 - k. Us Aire
2. Material: Aluminum.
3. Finish: Baked enamel, color selected by Architect.
4. Face Arrangement: Perforated core.
5. Frame: **1-1/4 inches (32 mm)** wide.
6. Mounting Frame: Filter.
7. Mounting: Concealed.
8. Damper Type: Adjustable opposed-blade assembly.

2.3 CEILING DIFFUSER OUTLETS

A. Round Ceiling Diffuser:

1. Available Manufacturers:

- a. Anemostat; a Mestek Company.
 - b. Carnes.
 - c. Hart & Cooley, Inc.; Hart & Cooley Div.
 - d. METALAIRE, Inc.; Metal Industries Inc.
 - e. Nailor Industries of Texas Inc.
 - f. Price Industries.
 - g. Titus.
 - h. Tuttle & Bailey.
 - i. US Aire
2. Material: Aluminum.
 3. Finish: Baked enamel, color selected by Architect.
 4. Face Style: Four, Three, or Two cone.
 5. Pattern: Fully adjustable.
 6. Dampers: Radial opposed blade.
 7. Accessories:
 - a. Equaling grid.
 - b. Plaster ring.
 - c. Safety chain.
 - d. Wire guard.
 - e. Sectorizing baffles.
 - f. Operating rod extension.

B. Rectangular and Square Ceiling Diffusers:

1. Available Manufacturers:
 - a. A-J Manufacturing Co., Inc.
 - b. Anemostat; a Mestek Company.
 - c. Carnes.
 - d. Hart & Cooley, Inc.; Hart & Cooley Div.
 - e. Krueger.
 - f. METALAIRE, Inc.; Metal Industries Inc.
 - g. Nailor Industries of Texas Inc.
 - h. Price Industries.
 - i. Titus.
 - j. Tuttle & Bailey.
 - k. US Aire
2. Material: Aluminum.
3. Finish: Baked enamel, color selected by Architect.
4. Face Size: See drawings.
5. Face Style: Four cone.
6. Mounting: Surface.
7. Pattern: Adjustable.
8. Dampers: Radial opposed blade.
9. Accessories:
 - a. Equaling grid.

- b. Plaster ring.
- c. Safety chain.
- d. Wire guard.
- e. Sectorizing baffles.
- f. Operating rod extension.

C. Perforated Diffuser:

1. Available Manufacturers:

- a. Air Research Diffuser Products, Inc.
- b. A-J Manufacturing Co., Inc.
- c. Anemostat; a Mestek Company.
- d. Carnes.
- e. Hart & Cooley, Inc.; Hart & Cooley Div.
- f. Krueger.
- g. METALAIR, Inc.; Metal Industries Inc.
- h. Nailor Industries of Texas Inc.
- i. Price Industries.
- j. Titus.
- k. Tuttle & Bailey.
- l. Warren Technology.
- m. US Aire

2. Material: Steel backpan and pattern controllers, with aluminum face.

3. Finish: Baked enamel, color selected by Architect.

a. Face Size: US Aire

4. Duct Inlet: Round or Square.

5. Face Style: Flush.

6. Pattern Controller: Adjustable with louvered pattern modules at inlet.

7. Mounting: Surface.

8. Dampers: Opposed blade.

9. Accessories:

- a. Equaling grid.
- b. Plaster ring.
- c. Safety chain.
- d. Wire guard.
- e. Sectorizing baffles.
- f. Operating rod extension.

D. Louver Face Diffuser:

1. Available Manufacturers:

- a. A-J Manufacturing Co., Inc.
- b. Anemostat; a Mestek Company.
- c. Carnes.

- d. METALAIR, Inc.; Metal Industries Inc.
 - e. Nailor Industries of Texas Inc.
 - f. Price Industries.
 - g. Titus.
 - h. Tuttle & Bailey.
 - i. US Aire
- 2. Material: Aluminum.
 - 3. Finish: Baked enamel, color selected by Architect.
 - 4. Face Size: See drawings.
 - 5. Mounting: Surface.
 - 6. Pattern: See drawings.
 - 7. Dampers: Radial opposed blade.
 - 8. Accessories:
 - a. Square to round neck adaptor.
 - b. Adjustable pattern vanes.
 - c. Throw reducing vanes.
 - d. Equaling grid.
 - e. Plaster ring.
 - f. Safety chain.
 - g. Wire guard.
 - h. Sectorizing baffles.
 - i. Operating rod extension.

2.4 SOURCE QUALITY CONTROL

- A. Verification of Performance: Rate diffusers, registers, and grilles according to ASHRAE 70, "Method of Testing for Rating the Performance of Air Outlets and Inlets."

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install diffusers, registers, and grilles level and plumb.
- B. Ceiling-Mounted Outlets and Inlets: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated, as much as practicable. For units installed in lay-in ceiling panels, locate units in the center of panel. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.
- C. Install diffusers, registers, and grilles with airtight connections to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

3.2 ADJUSTING

- A. After installation, adjust diffusers, registers, and grilles to air patterns indicated, or as directed, before starting air balancing.

END OF SECTION

SECTION 26 05 00 - COMMON WORK RESULTS FOR ELECTRICAL

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. Electrical equipment coordination and installation.
 - 2. Sleeves for raceways and cables.
 - 3. Sleeve seals.
 - 4. Grout.
 - 5. Common electrical installation requirements.
 - 6. Commissioning requirements.

1.3 DEFINITIONS

- A. EPDM: Ethylene-propylene-diene terpolymer rubber.
- B. NBR: Acrylonitrile-butadiene rubber.

1.4 GENERAL REQUIREMENTS

- A. Carefully examine General Conditions, other specification sections, and other drawings (in addition to DIVISION 26), in order to be fully acquainted with their effect on electrical work. Additions to the contract cost will not be allowed due to failure to inspect existing conditions.
- B. Do all work in compliance with 2014 Florida Building Code with supplements, and the Codes adopted therein, including NFPA 70 (2011 NEC), 2011 Florida Fire Prevention Code and the regulations of the local power utility, cable television and telephone companies. Obtain and pay for any and all required permits, inspections, certificates of inspections and approval, and the like, and deliver such certificates to the Architect/Engineer.
- C. Cooperate and coordinate with all other trades. Perform work in such manner and at such times as not to delay work of other trades. Complete all work as soon as the condition of the structure and installations of equipment will permit. Patch, in a satisfactory manner and by the proper craft, any work damaged by electrical workmen.
- D. Furnish, perform, or otherwise provide all labor (including, but not limited to, all planning, purchasing, transporting, rigging, hoisting, storing, installing, testing, chasing, channeling, cutting, trenching, excavating and backfilling), coordination, field verification, equipment installation, support, and safety, supplies, and materials necessary for the correct installation of complete and functional electrical systems (as described or implied by these specifications and the applicable drawings).

- E. Coordinate and verify power and telephone company service requirements prior to bid. Bid to include all work required.
- F. Circuiting and connection of all items using electric power shall be included under this division of the specifications, including necessary wire, conduit, circuit protection, disconnects and accessories. Secure rough-in drawings and connection information for equipment involved to determine the exact requirements. See all divisions of drawings or specifications for electrically operated equipment. If the connection of an item is not shown on the electrical drawings and it is unclear how to provide for the circuiting and connection, notify the engineer of record in writing prior to bidding project. Submission of a bid indicates that the bidder has included these requirements as part of the scope of work.

1.5 DRAWINGS:

- A. Indicate only diagrammatically the extent, general character, and approximate location of work. Where work is indicated, but with minor details omitted, furnish and install it complete and so as to perform its intended functions.
- B. DIVISION 26 work called for under any section of the project specifications, shall be considered as included in this work unless specifically excluded by inclusion in some other branch of the work. This shall include roughing-in for connections and equipment as called for or inferred. Check all drawings and specifications for the project and shall be responsible for the installation of all DIVISION 26 work.
- C. Take finish dimensions at the job site in preference to scale dimensions. Do not scale drawings where specific details and dimensions for DIVISION 26 work are not shown on the drawings, take measurements and make layouts as required for the proper installation of the work and coordination with all drawings and coordination with all other work on the project. In case of any discrepancies between the drawings and the specifications that have not been clarified by addendum prior to bidding, it shall be assumed by the signing of the contract that the higher cost (if any difference in costs) is included in the contract price, and perform the work in accordance with the drawings or with the specifications, as determined and approved by the Architect/ Engineer, and no additional costs shall be allowed to the base contract price.
- D. Carefully check the drawings and specifications of all trades and divisions before installing any of his work. He shall in all cases consider the work of all other trades, and shall coordinate his work with them so that the best arrangements of all equipment, piping, conduit, ducts, rough-in, etc., can be obtained.
- E. Review the specific equipment (such as mechanical, plumbing, kitchen, FFE, etc) minimum circuit ampacity and maximum over current protection requirements of equipment provided by others to confirm it is properly coordinated with the devices being purchased. Notify the AE team immediately upon discovery of discrepancies. This shall be done at the submittal stage prior to purchasing over current protection or installation of conduit, wire, disconnects, breakers, etc. No cost will be allowed for changes to coordinate.
- F. Locations designated for outlets, switches, equipment, etc., are approximate and shall be verified by instruction in these specifications and/or notes on the drawings. Where instructions or notes are insufficient to convey the intent of the design, consult the Architect/Engineer prior to installation.
- G. Obtain manufacturer's data on all equipment, the dimensions of which may affect electrical work. Use this data to coordinate proper service characteristics, entry locations, etc., and to ensure minimum clearances are maintained.

1.6 QUALIFICATIONS OF CONTRACTOR:

- A. DIVISION 26 Contractor shall have had experience of at least the same size and scope as this project, on at least two other projects within the last five years in order to be qualified to bid this project.
- B. Contractor performing any part of this scope of work shall be a State Certified (Type E.C. License) electrical contractor
- C. Provide field superintendent who has had a minimum of four (4) years previous successful experience on projects of comparable size and complexity. Superintendent shall be on the site at all times during construction and must have an active Journeyman's Electrical License.

1.7 SITE VISIT/CONDITIONS

- A. Visit the site of this contract and thoroughly familiarize with all existing field conditions and the proposed work as described or implied by the contract documents. During the course of his site visit, verify every aspect of the proposed work and the existing field conditions in the areas of construction which might affect his work. No compensation or reimbursement for additional expenses incurred due to failure or neglect to make a thorough investigation of the contract documents and the existing site conditions will be permitted.
- B. Install all equipment so that all Code required and Manufacturer recommended servicing clearances are maintained. Coordinate the proper arrangement and installation of all equipment within any designated space. If it is determined that a departure from the Contract Documents is necessary, submit to the A/E, for approval, detailed drawings of the proposed changes with written reasons for the changes. No changes shall be implemented without the issuance of the required drawings, clarifications, and/or change orders.
- C. Submission of a proposal will be construed as evidence that such examination has been made and later claims for labor, equipment or materials required because of difficulties encountered will not be recognized.
- D. Existing conditions and utilities indicated are taken from existing construction documents, surveys, and field investigations. Unforeseen conditions probably exist and existing conditions shown on drawings may differ from the actual existing installation with the result being that new work may not be field located exactly as shown on the drawings. Field verify dimensions of all site utilities, conduit routing, boxes, etc., prior to bidding and include any deviations in the contract. Notify A/E if deviations are found.
- E. All existing electrical is not shown. Become familiar with all existing conditions prior to bidding, and include in the bid the removal of all electrical equipment, wire, conduit, devices, fixtures, etc. that is not being reused, back to it's originating point.
- F. Locate all existing utilities and protect them from damage. Pay for repair or replacement of utilities or other property damaged by operations in conjunction with the completion of this work.
- G. Investigate site thoroughly and reroute all conduit and wiring in area of construction in order to maintain continuity of existing circuitry. Existing conduits indicated in Contract Documents indicate approximate locations. Verify and coordinate existing site conduits and pipes prior to any excavation on site. Bids shall include hand digging and all required rerouting in areas of existing conduits or pipes.

- H. Work is in connection with existing buildings which must remain in operation while work is being performed. Work shall be in accord with the schedule required by the Contract. Schedule work for a minimum outage to Owner. Notify Owner 72 hours in advance of any shut-down of existing systems. Perform work during non-business operating hours unless otherwise accepted by Owner. Protect existing buildings and equipment during construction.

PART 2 - PRODUCTS

2.1 NOT USED

PART 3 - EXECUTION

3.1 COMMON REQUIREMENTS FOR ELECTRICAL INSTALLATION

- A. Engineer shall have no responsibility for job site safety and the Contractor shall have full and sole authority for all safety programs and precautions in connection with the Work. Nothing herein shall be interpreted to confer upon the Engineer any duty regarding safety or the prevention of accidents at the jobsite.
- B. Comply with NECA 1.
- C. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounting items.
- D. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.
- E. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both electrical equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.
- F. Right of Way: Give to piping systems installed at a required slope.
- G. All work shall be executed in a workmanship manner and shall present a neat mechanical appearance upon completion.
- H. Care shall be exercised that all items are plumb, straight, level.
- I. Care shall be exercised so that Code clearance is allowed for all panels, controls. etc., requiring it. Do not allow other trades to infringe on this clearance.
- J. Balance load as equally as practicable on all feeders, circuits and panel buses.
- K. The electrical circuits, components and controls for all equipment are selected and sized based on the equipment specified. If substitutions are proposed, furnish all materials and data required to prove equivalence. No additional charges shall be allowed if additional materials, labor, connections or equipment are needed for substituted products.

3.2 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. Electrical penetrations occur when raceways, cables, wireways, cable trays, or busways penetrate concrete slabs, concrete or masonry walls, or fire-rated floor and wall assemblies.
- B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.
- C. Coordinate with roofing scope of work for the installation of electrical items which pierce roof. Roof penetrations shall not void warranty. Pitch pockets are not acceptable.
- D. Where work pierces waterproofing, it shall maintain the integrity of the waterproofing. Coordinate roofing materials which pierce roof for compatibility with membrane or other roof types.
- E. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
- F. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.
- G. Cut sleeves to length for mounting flush with both surfaces of walls.
- H. Extend sleeves installed in floors **2 inches** above finished floor level.
- I. Size pipe sleeves to provide **1/4-inch** annular clear space between sleeve and raceway or cable, unless indicated otherwise.
- J. Seal space outside of sleeves with grout for penetrations of concrete and masonry
- K. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Division 07 Section "Joint Sealants."
- L. Fire-Rated-Assembly Penetrations: Firestop penetrations of walls, partitions, ceilings, and floors under Division 07 Section "Firestopping."
- M. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work. The use of pitch pockets is not acceptable.

3.3 CONCRETE PADS

- A. Furnish and install reinforced concrete housekeeping pads for transformers, switchgear, motor control centers, and other free-standing equipment. Unless otherwise noted, pads shall be four (4) inches high and shall exceed dimensions of equipment being set on them, including future sections, by three (3) inches each side, except when equipment is flush against a wall where the side against the wall shall be flush with the equipment.
- B. Provide concrete pad for exterior pad mount transformers as required by power company.
- C. Provide concrete pad for exterior generators as recommended by generator manufacturer and structural engineer (8" minimum).

END OF SECTION 26 05 00

SECTION 26 05 19 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

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. Building wires and cables rated 600 V and less.
 - 2. Connectors, splices, and terminations rated 600 V and less.
 - 3. Sleeves and sleeve seals for cables.

1.3 DEFINITIONS

- A. EPDM: Ethylene-propylene-diene terpolymer rubber.
- B. NBR: Acrylonitrile-butadiene rubber.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated. Provide type and UL listing of each type of conductor, cable, connector and termination to be utilized for the DIVISION 26 scope of work.
- B. Field quality-control test reports.

1.5 QUALITY ASSURANCE

- A. Listing and Labeling: Provide wires and cables specified in this Section that are listed and labeled as defined in NFPA 70, Article 100.
- B. Comply with NFPA 70.

1.6 COORDINATION

- A. Coordinate layout and installation of cables with other installations.
- B. Revise locations and elevations from those indicated, as required to suit field conditions and as approved by Engineer.

PART 2 - PRODUCTS

2.1 CONDUCTORS AND CABLES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Alcan Products Corporation; Alcan Cable Division.
 2. American Insulated Wire Corp.; a Leviton Company.
 3. General Cable Corporation.
 4. Senator Wire & Cable Company.
 5. Southwire Company.
- B. BUILDING WIRES AND CABLES
1. CONDUCTOR INSULATION
 - a. Comply with NEMA WC 70 for Types THHN-THWN
 - b. Service Entrance: Type THHN-THWN CU or XHHW-2 Al, single conductors in raceway.
 - c. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspace: Type THHN-THWN, single conductors in raceway.
 - d. Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN-THWN, single conductors in raceway.
 - e. Feeders Installed below Raised Flooring: Type THHN-THWN, single conductors in raceway.
 - f. Exposed Branch Circuits, Including in Crawlspace: Type THHN-THWN, single conductors in raceway.
 - g. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN-THWN, single conductors in raceway or Metal-clad cable, Type MC (MC may only be utilized in certain specific installations as described elsewhere in this section).
 - h. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN-THWN, single conductors in raceway. Minimum #12.
 - i. Branch Circuits Installed below Raised Flooring: Type THHN-THWN, single conductors in raceway. Minimum #12.
 - j. Cord Drops and Portable Appliance Connections: Type SO, hard service cord with stainless-steel, wire-mesh, strain relief device at terminations to suit application.
 - k. Class 1 Control Circuits: Type THHN-THWN, in raceway.
 - l. Class 2 Control Circuits: Type THHN-THWN, in raceway.
 2. CONDUCTOR MATERIAL:
 - a. Copper Conductors: Comply with NEMA WC 70.
 - b. All #10 and smaller conductors shall be solid CU. No stranded conductors are permitted for #10 and smaller.
 - c. Aluminum conductors may be used for 1/0 and larger panel board feeders if identified as aluminum on the electrical feeder schedule. Aluminum conductors shall be compact stranded aluminum alloy with XHHW-2 insulation, made of an AA-8000 series electrical grade aluminum alloy conductor material.

2.2 CONNECTORS AND SPLICES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. AFC Cable Systems, Inc.
 - 2. AMP Incorporated
 - 3. Anderson
 - 4. O-Z/Gedney; EGS Electrical Group LLC.
 - 5. 3M; Electrical Products Division.
 - 6. Burndy
- B. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.
- C. Aluminum connections shall be made with compression type wire barrels factory prefilled with oxide inhibiting compound. Set screw connectors are not acceptable.

PART 3 - EXECUTION

3.1 INSTALLATION OF CONDUCTORS AND CABLES IN RACEWAY

- A. No cables shall be installed in raceways until the raceway system is complete from end to end.
- B. Examine raceways and building finishes to confirm compliance with contract requirements for installation tolerances and other conditions affecting installation of wires and cables. Do not proceed with installation until area is ready and any unsatisfactory conditions have been corrected.
- C. Verify that interior of building has been protected from weather.
- D. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.
- E. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.
- F. Identify and color-code conductors and cables according to Division 26 Section "Identification for Electrical Systems."
- G. All branch circuit wire shall be sized for a maximum voltage drop of 3%. The contractor shall size all cables to comply with this requirement. Below are some guidelines that may be followed to achieve the correct voltage drop in lieu of providing custom calculations for each case.
 - 1. Use conductor not smaller than #12 AWG for all 120V 20A branch circuits less than 60' in length from the source breaker to any device.
 - 2. All 120V branch circuit conductors where the length is 61' to 120' from the source breaker to any device shall utilize #10 minimum throughout the circuit, unless otherwise noted.
 - 3. All 120V branch circuit conductors where the length is 121' to 240' from the source breaker to any device shall utilize # 8 minimum throughout the circuit, unless otherwise noted.

4. All 120V branch circuit conductors where the length is greater than 241' from the source breaker to any device shall utilize # 6 minimum throughout the circuit, unless otherwise noted.
 5. Use conductor not smaller than #12 AWG for all 277V 20A branch circuits less than 140' in length from the source breaker to any device.
 6. All 277V branch circuit conductors where the length is 141' to 220' from the source breaker to any device shall utilize #10 minimum throughout the circuit, unless otherwise noted.
 7. All 277V branch circuit conductors where the length is 221' to 340' from the source breaker to any device shall utilize # 8 minimum throughout the circuit, unless otherwise noted.
 8. All 277V 20A branch circuit conductors where the length is greater than 341' from the source breaker to any device shall utilize # 6 minimum throughout the circuit, unless otherwise noted.
- H. Provide a dedicated neutral conductor for all dimmer circuits from the load back to the dimmer module or switch.
- I. Provide a dedicated neutral conductor for all computer receptacle circuits from the load back to the branch circuit panel board.
- J. Neatly train and lace wiring inside boxes, equipment, and panelboards.
- K. Conductor sizes indicated on circuit homeruns or in schedules shall be installed over the entire length of the circuit unless noted otherwise on the drawings or in these specifications.
- L. Before installing raceways and pulling wire to any mechanical equipment, verify electrical characteristics with final submittal on equipment to assure proper number and AWG of conductors. (As for multiple speed motors, different motor starter arrangements, etc.).
- M. Coordinate all wire sizes with lug sizes on equipment, devices, etc. Provide/install lugs as required to match wire size.

3.2 CONNECTIONS

- A. Where oversized conductors are called for (due to voltage drop, etc.) provide/install lugs as required to match conductors, or provide/install splice box, and splice to reduce conductor size to match lug size.
- 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 and UL 486B.
- C. All aluminum connections shall be made with approved compression connectors before being connected to lugs. Conductors shall be cleaned with a wire brush immediately prior to connecting.
- D. Make splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.
- E. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches of slack.
- F. Power and lighting conductors shall be continuous and unspliced where located within conduit. Splices shall occur within troughs, wireways, outlet boxes, or equipment enclosures where

sufficient additional room is provided for all splices. No splices shall be made in in-ground pull boxes (without written acceptance of engineer).

- G. Splices in lighting and power outlet boxes, wireway, and troughs shall be kept to a minimum, pull conductors through to equipment, terminal cabinets, and devices.
- H. No splices shall be made in junction box, and outlet boxes (wire No. 8 and larger) without written acceptance of Engineer.
- I. 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. A calibrated torque wrench shall be used for all bolt tightening.
- J. All interior power and lighting taps and splices in No. 8 or smaller shall be fastened together by means of "spring type" connectors. All taps and splices in wire larger than No. 8 shall be made with compression type connectors and taped to provide insulation equal to wire. Utilize weatherproof connectors for all splices in exterior boxes.
- K. No splices are permitted in exterior below grade handhole or pull boxes.

3.3 FIELD QUALITY CONTROL

- A. After feeders are in place, but before being connected to devices and equipment, test for shorts, opens, and for intentional and unintentional grounds.
- B. Cables 600 volts or less in size #1/0 and larger shall be meggered using an industry approved "megger" with 1000 V internal generating voltage. Readings shall be recorded and submitted to the Engineer for acceptance prior to energizing same. If values are less than recommended NETA values notify Engineer. Submit five copies of tabulated megger test values for all cables.
- C. Cables 250 volts or less in size #1/0 and larger shall be meggered using an industry approved "megger" with 500 V internal generating voltage. Readings shall be recorded and submitted to the Engineer, for acceptance prior to energizing same. Submit five copies of tabulated megger test values for all cables.
- D. Perform Insulation resistance test and turns ratio test. Submit five copies to engineer at substantial completion.
- E. Remove and replace malfunctioning units and retest as specified above.

END OF SECTION 26 05 19

SECTION 26 05 26 - GROUNDING AND BONDING FOR ELECTRICAL 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. This Section includes methods and materials for grounding systems, equipment and common ground bonding with lightning protection system.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Field quality-control test reports.

1.4 QUALITY ASSURANCE

- A. Comply with UL 467 for grounding and bonding materials and equipment.
- B. Test all ground rod locations as described to confirm quality standard intent is attained.

PART 2 - PRODUCTS

2.1 CONDUCTORS

- A. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.
- B. Bare Copper Conductors:
 - 1. Solid Conductors: ASTM B 3.
 - 2. Stranded Conductors: ASTM B 8.
 - 3. Tinned Conductors: ASTM B 33.
 - 4. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch in diameter.
 - 5. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
 - 6. Bonding Jumper: Copper tape, braided conductors, terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.
- C. Grounding Bus: Rectangular bars of annealed copper, 1/4 by 4 inches in cross section, unless otherwise indicated; with insulators.

2.2 CONNECTORS

- A. Listed and labeled by a nationally recognized testing laboratory acceptable to authorities having jurisdiction for applications in which used, and for specific types, sizes, and combinations of conductors and other items connected.
- B. Bolted Connectors for Conductors and Pipes: Copper or copper alloy, bolted pressure-type, with at least two bolts.
 - 1. Pipe Connectors: Clamp type, sized for pipe.
- C. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.
- D. Lugs: Compression of substantial construction, cast copper or cast bronze, with "ground" (micro-flat) surfaces, twin clamp, two-hole tongue, equal to Burndy or equal by T&B or OZ Gedney. Lightweight and "competitive" devices shall be rejected.
- E. Grounding and Bonding Bushings: Malleable iron, Thomas and Betts (T&B), or equal.
- F. Grounding Screw and Pigtail: Raco No. 983 or equal.
- G. Building Structural Steel, Existing: Thompson 701 Series heavy duty bronze "C" clamp with two-bolt vise-grip cable clamp or equal.

2.3 GROUNDING ELECTRODES

- A. Ground Rods: Copper-clad steel, sectional type; 5/8 inch by 10 feet in diameter.

2.4 GROUNDING BARS/GROUND BUS (INCLUDING 'SYSTEMS' GROUND BUS/BARS AND GROUND BUS BARS)

- A. Ground bars shall be copper of the size and description as shown on the drawings. If not sized on drawings, bus bar shall be minimum 1/4" x 4" bus grade copper, spaced from wall on insulating 2" polyester molded insulator standoff/supports, and be 12" or greater minimum overall length, allowing 2" length per lug connected thereto. Increase overall length as required to facilitate all lugs required while maintaining 2" spacing. Size of bus bar used in main electrical room shall be similar except minimum of 4" high and 24" long.
- B. Provide bolt-tapping lug with two hex head mounting bolts for each terminating ground conductor, sized to match conductors. Mount on bus bar at 2 inches on center spacing. Lugs to be manufactured by Burndy or T&B.
- C. Standoff supports to be 2" polyester as manufactured by Glastic #2015-4C.

PART 3 - EXECUTION

3.1 EQUIPMENT GROUNDING CONDUCTOR

- A. Provide separate, insulated (bare if with feeder in PVC conduit outside of building(s)) conductor within each feeder and branch circuit raceway. Terminate each end on suitable lug, bus, or bushing.
- B. Provide green insulated ground wire for all grounding type receptacles and for equipment of all voltages. In addition to grounding strap connection to metallic outlet boxes, a supplemental grounding wire and screw equal to Raco No. 983 shall be provided to connect receptacle ground terminal to the box.
- C. All plugstrips and metallic surface raceway shall contain a green insulation ground conductor from supply panel ground bus connected to grounding screw on each receptacle in strip and to strip channel. Conductor shall be continuous.
- D. All motors, all heating coil assemblies, and all building equipment requiring flexible connections shall have a green grounding conductor properly connected to the frames and extending continuously inside conduit with circuit conductors to the supply source bus with accepted connectors regardless of conduit size or type. This shall include Food Service equipment, Laundry equipment, and all other "Equipment By Owner" to which an electric conduit is provided under this Division.

END OF SECTION 26 05 26

SECTION 26 05 29 - HANGERS AND SUPPORTS FOR ELECTRICAL 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. This Section includes the following:
 - 1. Hangers and supports for electrical equipment and systems.
 - 2. Construction requirements for concrete bases.

1.3 DEFINITIONS

- A. EMT: Electrical metallic tubing.
- B. IMC: Intermediate metal conduit.
- C. RMC: Rigid metal conduit.

1.4 PERFORMANCE REQUIREMENTS

- A. Design supports for multiple raceways capable of supporting combined weight of supported systems and its contents.
- B. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
- C. Rated Strength: Adequate in tension, shear, and pullout force to resist maximum loads calculated or imposed for this Project, with a minimum structural safety factor of five times the applied force.
- D. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and shown.

1.5 SUBMITTALS

- A. Product Data: For the following:
 - 1. Unistrut
 - 2. Straps
 - 3. Clamps
 - 4. Rods
 - 5. Hangers

6. Anchors
7. Attachment Devices

- B. Shop Drawings: Show fabrication and installation details and include calculations for the following:
1. Trapeze hangers. Include Product Data for components.
 2. Steel slotted channel systems. Include Product Data for components.
 3. Nonmetallic slotted channel systems. Include Product Data for components.
 4. Equipment supports.

1.6 QUALITY ASSURANCE

- A. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

- A. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Cooper B-Line, Inc.; a division of Cooper Industries.
 - b. ERICO International Corporation.
 - c. Thomas & Betts Corporation.
 - d. Unistrut; Tyco International, Ltd.
 - e. Wesanco, Inc.
 2. Metallic Coatings: Exterior of the building utilize stainless steel or hot-dip galvanized after fabrication and applied according to MFMA-4. Interior utilize electro-galvanized steel products.
 3. Nonmetallic Coatings: Manufacturer's standard PVC, polyurethane, or polyester coating applied according to MFMA-4.
 4. Channel Dimensions: Selected for applicable load criteria.
- B. Nonmetallic Slotted Support Systems: Structural-grade, factory-formed, glass-fiber-resin channels and angles with 9/16-inch diameter holes at a maximum of 8 inches o.c., in at least 1 surface.
1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Cooper B-Line, Inc.; a division of Cooper Industries.
 - b. Fabco Plastics Wholesale Limited.
 - c. T & B/Carlton
 - d. Seasafe, Inc.

2. Fittings and Accessories: Products of channel and angle manufacturer and designed for use with those items.
 3. Fitting and Accessory Materials: Same as channels and angles, except metal items may be stainless steel.
 4. Rated Strength: Selected to suit applicable load criteria.
- C. Raceway and Cable Supports: As described in NECA 1 and NECA 101.
- D. Conduit and Cable Support Devices: Steel and malleable-iron hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.
- E. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be malleable iron.
- F. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
- G. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:
1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
 - a. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1) Hilti Inc.
 - 2) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
 - 3) MKT Fastening, LLC.
 - 4) Simpson Strong-Tie Co., Inc.; Masterset Fastening Systems Unit.
 2. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel, for use in hardened portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.
 - a. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1) Cooper B-Line, Inc.; a division of Cooper Industries.
 - 2) Empire Tool and Manufacturing Co., Inc.
 - 3) Hilti Inc.
 - 4) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
 - 5) MKT Fastening, LLC.
 3. Concrete Inserts: Steel or malleable-iron, slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.
 4. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.
 5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
 6. Toggle Bolts: All-steel springhead type.

7. Hanger Rods: Threaded steel.

2.2 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

- A. Description: Welded or bolted, structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.
- B. Materials: Comply with requirements in Division 05 Section "Metal Fabrications" for steel shapes and plates.

PART 3 - EXECUTION

3.1 APPLICATION

- A. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems except if requirements in this Section are stricter.
- B. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMT, IMC, and RMC as required by NFPA 70. Minimum rod size shall be 1/4 inch (6 mm) in diameter.
- C. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted support system, sized so capacity can be increased by at least 25percent in future without exceeding specified design load limits.

3.2 SUPPORT INSTALLATION

- A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this Article.
- B. Raceway Support Methods: In addition to methods described in NECA 1, EMT, IMC, and RMC may be supported by openings through structure members, as permitted in NFPA 70.
- C. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb (90 kg).
- D. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:
 1. To Wood: Fasten with lag screws or through bolts.
 2. To New Concrete: Bolt to concrete inserts.
 3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
 4. To Existing Concrete: Expansion anchor fasteners.
 5. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inches (100 mm) thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches (100 mm) thick.

6. To Steel: Welded threaded studs complying with AWS D1.1/D1.1M, with lock washers and nuts, beam clamps (MSS Type 19, 21, 23, 25, or 27) complying with MSS SP-69 or spring-tension clamps.
 7. To Light Steel: Sheet metal screws.
 8. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate by means that meet seismic-restraint strength and anchorage requirements.
- E. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.
 - F. Do not support conduit or raceway with wire, metal banding material, or perforated pipe straps. Remove wire used for temporary supports
 - G. Do not attach conduit or raceway to ceiling support wires.
 - H. Conduits or raceways shall not be supported from ceiling grid supports, plumbing pipes, duct systems, heating or air conditioning pipes, or other building systems.
 - I. Non-bolted conduit clamps, spring type conduit clamps, and tie wire are not acceptable for supports. All conduits must be supported with bolted hangers listed for the specific installed application.

3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

- A. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.

END OF SECTION 26 05 29

SECTION 26 05 33 - RACEWAY AND BOXES FOR ELECTRICAL 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. This Section includes raceways, fittings, boxes, enclosures, and cabinets for electrical wiring.

1.3 DEFINITIONS

- A. EMT: Electrical metallic tubing.
- B. ENT: Electrical nonmetallic tubing.
- C. EPDM: Ethylene-propylene-diene terpolymer rubber.
- D. FMC: Flexible metal conduit.
- E. LFMC: Liquidtight flexible metal conduit.
- F. LFNC: Liquidtight flexible nonmetallic conduit.
- G. NBR: Acrylonitrile-butadiene rubber.
- H. RNC: Rigid nonmetallic conduit.

1.4 SUBMITTALS

- A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.
- B. Shop Drawings: For the following raceway components. Include plans, elevations, sections, details, and attachments to other work.
 - 1. Custom enclosures and cabinets.
 - 2. For handholes and boxes for underground wiring, including the following:
 - a. Duct entry provisions, including locations and duct sizes.
 - b. Frame and cover design.
 - c. Grounding details.
 - d. Dimensioned locations of cable rack inserts, and pulling-in and lifting irons.
 - e. Joint details.

- C. Coordination Drawings: Conduit routing plans, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:
 - 1. Structural members in the paths of conduit groups with common supports.
 - 2. HVAC and plumbing items and architectural features in the paths of conduit groups with common supports.

1.5 REFERENCES

- A. ANSI C80.1 - Rigid Steel Conduit - Zinc Coated
- B. ANSI C80.3 - Electrical Metallic Tubing - Zinc Coated
- C. ANSI C80.5 - Aluminum Rigid Conduit (ARC)
- D. ANSI/NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing and Cable
- E. ANSI/NEMA OS 1 - Sheet-steel Outlet Boxes, Device Boxes, Covers, and Box Supports.
- F. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).
- G. ANSI/NFPA 70 - National Electrical Code
- H. NECA Standard Practices for Good Workmanship in Electrical Contracting
- I. NEMA RN 1 - Polyvinyl Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit.
- J. NEMA TC 2 - Electrical Polyvinyl Chloride (PVC) Conduit (EPC 40, EPC 80)
- K. NEMA TC 3 - Polyvinyl Chloride (PVC) Fittings for Use with Rigid PVC Conduit and Tubing

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.

PART 2 - PRODUCTS

2.1 METAL CONDUIT AND TUBING

- A. Minimum Trade Size
 - 1. All Conduit (except switch legs) - 3/4" c.
 - 2. Switch legs - 1/2" c.
- B. RIGID METALLIC CONDUIT

1. Comply with:
 - a. ANSI C80.1
 - b. UL Spec - No. 6
 - c. NEC 344
2. Conduit material:
 - a. Zinc coated or hot dipped galvanized steel.
3. Fittings:
 - a. Threaded.
 - b. Insulated bushings shall be used on all rigid steel conduits terminating in panels, boxes, wire gutters, or cabinets, and shall be impact resistant plastic molded in an irregular shape at the top to provide smooth insulating surface at top and inner edge. Material in these bushings must not melt or support flame.
 - c. Zinc plated or hot dipped galvanized malleable iron or steel.
4. Conduit Bodies:
 - a. Comply with ANSI/NEMA FB 1.
 - b. Threaded hubs.
 - c. Zinc plated or hot-dipped galvanized malleable iron.

C. RIGID ALUMINUM CONDUIT

1. Comply with:
 - a. ANSI C80.5
 - b. UL 6
 - c. NEC 344
2. Conduit material: Aluminum.
3. Fittings:
 - a. Threaded.
 - b. Aluminum.
 - c. Insulated bushings on terminations.
4. Conduit bodies:
 - a. Comply with ANSI/NEMA FB 1.
 - b. Threaded hubs.
 - c. Aluminum.

D. PVC-Coated Steel Conduit: PVC-coated rigid steel conduit.

1. Comply with:
 - a. UL 6
 - b. ANSI C80.1
 - c. NEC. 344
 - d. NEMA RN1

2. Conduit material: Hot-dipped galvanized rigid steel with external PVC coating, 20 mil. thick.
 3. Fittings:
 - a. Threaded.
 - b. Insulated bushings on terminations.
 - c. Zinc plated or hot-dipped galvanized malleable iron or steel with external PVC coating, 20 mil. thick.
 4. Conduit bodies:
 - a. Comply with:
 - b. ANSI/NEMA FB 1
 - c. Threaded hubs
 - d. Zinc plated or hot-dipped galvanized malleable iron with external PVC coating 20 mil thick.
- E. EMT: ANSI C80.3.
1. Comply with:
 - a. UL 797
 - b. ANSI C80.3
 - c. NEC 358
 - d. ANSI/UL797
 2. Conduit material: Galvanized steel tubing.
 3. Fittings:
 - a. ANSI/NEMA FB 1
 - b. Set screw, Die Cast for Interior Dry locations
 - c. Compression, Steel for all damp locations
- F. FMC: Zinc-coated steel or aluminum.
1. Comply with:
 - a. NEC 348
 - b. ANSI/UL 1
 2. Conduit material: Steel or aluminum, interlocked.
 3. Fittings:
 - a. ANSI/NEMA FB 1
 - b. ANSI/UL 514B
 - c. Die Cast
 - d. Threaded rigid conduit to flexible conduit coupling.
 - e. Direct flexible conduit bearing set screw type not acceptable.
- G. LFMC: Flexible steel conduit with PVC jacket.
1. Comply with:
 - a. NEC 350

- b. ANSI/UL 360
- 2. Conduit material:
 - a. Flexible hot-dipped galvanized steel core, interlocked.
 - b. Continuous copper ground built into core up to 1-1/4" size.
 - c. Extruded polyvinyl gray jacket.
- 3. Fittings:
 - a. Threaded for rigid conduit connections.
 - b. Accepted for hazardous locations where so installed.
 - c. Provide sealing washer in wet/damp locations.
 - d. Compression type.
 - e. ANSI/NEMA FB 1.
 - f. ANSI/UL 5148.
 - g. Zinc plated malleable iron or steel.

2.2 NONMETALLIC CONDUIT AND TUBING

- A. Minimum Trade Size – 3/4"
- B. RNC: NEMA TC 2, Schedule-40-PVC, unless otherwise indicated.
 - 1. Comply with:
 - a. NEMA TC-2
 - b. UL 651
 - c. NEC 352
 - 2. Conduit material:
 - a. Shall be high impact PVC - tensile strength 55 PSI, flexural strength 11000 PSI.
 - 3. Fittings:
 - a. Comply with: NEMA TC-3 and UL 514.

2.3 EXPANSION FITTINGS

- A. Expansion fittings shall be:
 - 1. UL Listed, hot dipped galvanized inside and outside providing a 4" expansion chamber - when used with rigid conduit and electrical metallic conduit, or:
 - 2. Be polyvinyl chloride and shall meet the requirements of and as specified elsewhere for non-metallic conduit and shall provide a 6" expansion chamber.
 - 3. Hot dipped galvanized expansion fitting shall be provided with an external braided grounding and bonding jumper with accepted clamps, UL Listed for the application.
 - 4. Expansion fitting, UL Listed for the application and in compliance with the National Electrical Code without the necessity of an external bonding jumper may be considered. Submit fitting with manufacturer's data and UL Listing for acceptance prior to installation.

2.4 METAL WIREWAYS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Cooper B-Line, Inc.
 - 2. Hoffman.
 - 3. Square D; Schneider Electric.
- B. Description: Sheet metal sized and shaped as indicated, NEMA 250, Type 1, unless otherwise indicated.
- C. 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.
- D. Wireway Covers: Hinged type.
- E. Finish: Manufacturer's standard enamel finish.

2.5 SURFACE RACEWAYS

- A. Surface Metal Raceways: Galvanized steel with snap-on covers. Manufacturer's standard enamel finish in color selected by Engineer.
 - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Thomas & Betts Corporation.
 - b. Walker Systems, Inc.; Wiremold Company (The).
 - c. Wiremold Company (The); Electrical Sales Division.
 - d. Mono-Systems, Inc.

2.6 BOXES, ENCLOSURES, AND CABINETS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Cooper Crouse-Hinds; Div. of Cooper Industries, Inc.
 - 2. EGS/Appleton Electric.
 - 3. Erickson Electrical Equipment Company.
 - 4. Hoffman.
 - 5. Hubbell Incorporated; Killark Electric Manufacturing Co. Division.
 - 6. O-Z/Gedney; a unit of General Signal.
 - 7. RACO; a Hubbell Company.
 - 8. Robroy Industries, Inc.; Enclosure Division.
 - 9. Scott Fetzer Co.; Adalet Division.
 - 10. Spring City Electrical Manufacturing Company.
 - 11. Thomas & Betts Corporation.
 - 12. Walker Systems, Inc.; Wiremold Company (The).
 - 13. Woodhead, Daniel Company; Woodhead Industries, Inc. Subsidiary.

B. Sheet Metal Outlet and Device Boxes: NEMA OS 1.

1. Luminaire and Equipment Supporting Boxes: Rated for weight of equipment supported; include 1/2 inch (13 mm) male fixture studs where required.
2. Concrete Ceiling Boxes: Concrete type.
3. Interior flush outlet boxes shall be one piece galvanized steel constructed with stamped knockouts in back and sides, and threaded holes with screws for securing box coverplates or wiring devices.
4. Ceiling outlet boxes shall be 4" octagonal or 4" square X 1 1/2" deep or larger as required for number and size of conductors and arrangement, size and number of conduits terminating at them.
5. Switch, wall receptacle, telephone and other recessed wall outlet boxes in drywall shall be a minimum of 4" square X 1 1/2" deep. For recessing in exposed masonry, provide one piece 4" square x 1 1/2" deep wall boxes with appropriate 4" square cut tile wall covers. For recessing in furred-out block walls, provide 4" square box with required extension for block depth and required extension for drywall depth.
6. Boxes shall be of such form and dimensions as to be adapted to the specific use and location, type of device or fixtures to be used, and number and size of conductors and arrangement, size and number of conduits connecting thereto.
7. Handy boxes shall not be used for any purpose.
8. Where a box is used as the sole support for a ceiling paddle fan, the box must be listed for this purpose and the weight of the fan.

C. Cast-Metal Outlet and Device Boxes: NEMA FB 1, Type FD, with gasketed cover.

1. Interior surface outlet boxes and conduit bodies installed from 0" AFF to 90" AFF (including fire alarm device backbox) shall be the heavy cast aluminum or iron with external threaded hubs for power devices and threaded parts for low voltage devices. Trim rings shall also be of one-piece construction.
2. Weatherproof outlet boxes shall be constructed of corrosion-resistant cast metal suited to each application and having threaded conduit hubs, cast metal faceplate with spring-hinged waterproof cap suitable configured, gasket, and corrosion-proof fasteners.
3. Freestanding cast boxes are to be type FSY (with flange). Other cast zinc boxes are not acceptable.

D. Floor Boxes:

1. For all slab on grade areas except wet locations and wooden floors: Cast iron or steel with epoxy paint, fully adjustable before and after the concrete pour. The cover shall provide protection from water, dirt and debris. The cover will be flanged die cast aluminum with brushed aluminum finish that will accept carpet or tile cutouts to match flooring. The box shall be capable of adapting to most power and communications needs. Provide all activations, barriers and brackets required for the particular installation. Design Selection is Wiremold RFB 4 (based on required outlets) or equal.
2. Wood Floors: Cast iron or steel fully adjustable, rectangular, multi-gang box. The cover shall provide protection from water, dirt and debris. The cover will be brass flip lids with appropriate multi gang ring to set flush with wood flooring. The box shall be capable of adapting to most power and communications needs.
3. Poke Thru's for all floor boxes in elevated slabs: Flush style round poke thru with combination power (2 duplex) and data (6 Cat6 outlets). Poke Thru shall be UL scrub water exclusion for tile and carpeted floors. Poke thru shall be maintains UL fire rated for up to 2 hour rated floors. Poke thru shall meet FBC and ADA accessibility guidelines.

E. Sheet Metal Pull and Junction Boxes: NEMA OS 1.

1. Pull and junction boxes (not in-ground type) larger than 25 square inches shall be hinged cover type with flush latches operated with screwdriver.
2. Large Pull Boxes: Boxes larger than 400 cubic inches in volume or 20 inches in any dimension:
 - a. Use continuous hinged enclosures with locking handle.
3. Exterior, damp location and wet location pull and junction boxes shall be Nema 4x stainless steel.

F. Cabinets (Control and Systems):

1. NEMA 250, Type 1, galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
2. Hinged door in front cover with flush latch and concealed hinge.
3. Metal barriers to separate wiring of different systems and voltage.
4. Accessory feet where required for freestanding equipment.

2.7 HANDHOLES AND BOXES FOR EXTERIOR UNDERGROUND WIRING

A. Description: Concrete ring with Nema 6P box inside (All Areas)

1. Color of Frame and Cover: Gray.
2. Configuration: Concrete ring shall be designed for flush burial and have open bottom, unless otherwise indicated.
3. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural traffic load rating consistent with enclosure.
4. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
5. Cover Legend: Molded lettering, "ELECTRIC.", "TELEPHONE." or as indicated for each service.
6. Nema 6P box rated for direct burial enclosure shall be located inside the concrete ring for termination of conduits.
7. Handholes 36 inches wide by 36 inches long and larger shall have inserts for cable racks and pulling-in irons installed before concrete is poured.

PART 3 - EXECUTION

3.1 RACEWAY LOCATION INSTALLATION REQUIREMENTS

A. Underground Installations:

1. Use rigid non-metallic conduit (PVC) only unless local authority having jurisdiction or applicable codes/utility requirements, etc. require rigid steel conduit.
2. All conduits or elbows entering, or leaving the ground shall be rigid steel conduit coated with asphaltic paint.
3. All underground raceways (with exception of raceways installed under floor slab) shall be installed in accordance with the NEC except that the minimum cover for any conduit shall be two feet. Included under this Section shall be the responsibility for verifying finished lines in areas where raceways will be installed underground before the grading is complete.

4. Where rigid metallic conduit is installed underground as noted above it shall be coated with waterproofing black mastic before installation, and all joints shall be re-coated after installation.
 5. Utilize rigid steel 90° elbows at each riser and at each change in direction. Elbows shall be coated with black mastic or PVC coating. Bond all metal elbows per NEC.
 6. All underground service lateral raceways shall be protected as required by the NEC including requirements for installation of warning tape.
- B. In Slab Above or on Grade:
1. Use coated rigid steel conduit or rigid non-metallic conduit.
 2. Coating of metallic conduit to be black asphaltic or PVC.
- C. Penetration of Slab:
1. Exposed Location subject to damage:
 - a. Where penetrating a floor in an exposed location subject to damage from underground or in slab, a black mastic coated or PVC coated galvanized rigid steel conduit shall be used.
 2. Interior Location not subject to damage:
 - a. Where penetrating a floor in a location concealed in block wall and acceptable by applicable codes, rigid non-metallic conduit may be used up to first outlet box, provided outlet box is at a maximum height of 40" above finished floor.
 - b. Where penetrating a floor in location other than that above, transition to metallic conduit at the floor.
- D. Outdoor Location:
1. Above Grade:
 - a. Where penetrating the finished grade, black mastic coated or PVC coated galvanized rigid steel conduit shall be used.
 - b. In general all exterior conduit runs shall be rigid steel conduit and threaded connectors as specified elsewhere.
 - c. Electrical metallic tubing (thin wall) is permitted under roof, overhangs, etc. provided it is not subjected to physical damage and is not in direct contact or directly subject to exterior elements including sunlight.
 2. Metal Canopies:
 - a. Conduit runs except for canopy lighting raceways are not to be run on (top or bottom) of metal canopies roof systems. All new conduit shown on or at these areas is to be run underground. Clamp back spacers shall be used on all canopies to prevent galvanic action from dissimilar metals. Conduits installed exposed from Building structure to Metal Canopies will not be permitted.
 3. Roofs:
 - a. Conduit is not to be installed on roofs, without written authorization by A/E and the Owner for specific conditions.
 - b. When accepted by written authorization conduit shall comply with the following:

- 1) Be PVC coated rigid galvanized metal conduit.
- 2) All fittings, etc. are to be PVC coated.
- 3) Conduit shall be supported above roof at least 6 inches using accepted conduit supporting devices. Refer to applicable sections of specifications on roofing, etc.
- 4) Supports to be fastened to roof using roofing adhesive or means compatible with roofing. Confirm the method used will not void the roofing warranty. The use of pitch pockets is not acceptable.

E. Interior Dry Locations:

1. Concealed: Use rigid galvanized steel conduit and electrical metallic tubing. Rigid non-metallic conduit may be used inside block walls up to first outlet to a maximum of 40" A.F.F. except where prohibited by the NEC (places of assembly, etc.).
2. Exposed: Use rigid galvanized steel or electrical metallic tubing. EMT may only be used where not subject to damage, which is interpreted by this specification to be above 90" AFF.
3. Concealed or exposed flexible conduit:
 - a. Concealed flexible steel conduit or seal tight flexible steel conduit in lengths not longer than six (6) feet in length with a ground conductor installed in the conduit or an equipment ground conductor firmly attached to the terminating fitting at the extreme end of the flex. Exposed flexible steel conduit or seal tight flexible steel conduit shall not exceed two (2) feet in length, unless written authorization by A/E for specific conditions is granted.

F. Interior Wet and Damp Locations:

1. Use rigid galvanized steel conduit.

G. Concrete Columns or Poured in-place Concrete Wall Locations:

1. Use rigid non-metallic conduit. Penetration shall be by accepted metal raceway (i.e. metal conduit as required elsewhere in these specifications).

3.2 RACEWAY INSTALLATION

- A. Comply with NECA 1 for installation requirements applicable to products specified in Part 2 except where requirements on Drawings or in this Article are stricter.
- B. All bending, cutting, and reaming shall be completed with tools specifically designed for the specific use.
- C. Expansion fittings shall be installed in the following cases:
 1. In each conduit run wherever it crosses an expansion joint in the concrete structure; on one side of joint with its sliding sleeve end flush with joint, and with a length of bonding jumper in expansion equal to at least three times the normal width of joints.
 2. In each conduit run which mechanically attached to separate structures to relieve strain caused by shift on one structure in relation to the other.
 3. In straight conduit run above ground which is more than one hundred feet long and interval between expansion fittings in such runs shall not be greater than 100 feet.

- D. Arrange conduit to maintain headroom and present neat appearance.
- E. Provide rigid steel long radius 90 degree sweeps (bend radius of 10 times the conduit trade size diameter) for all changes in direction (vertical and horizontal) for utility conduits. Comply with all installation requirements of the utility to utilize the conduits.
- F. Utility conduits shall be buried a minimum of 36" deep to the top of the conduit.
- G. Route conduit installed above accessible ceilings or exposed to view parallel or perpendicular to walls. Do not run from point to point.
- H. Do not cross conduits in slab.
- I. Use conduit hubs to fasten conduit to sheet metal boxes in damp and wet locations and to cast boxes.
- J. Keep raceways at least 6 inches (150 mm) away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.
- K. Complete raceway installation before starting conductor installation.
- L. Support raceways as specified in Division 26 Section "Hangers and Supports for Electrical Systems."
- M. Arrange stub-ups so curved portions of bends are not visible above the finished slab.
- N. Install no more than equivalent of three 90-degree bends between boxes. Use conduit bodies to make sharp changes in direction, as around beams. Use factory elbows for bends in metal conduit larger than 2 inch (50 mm) size.
- O. Provide continuous fiber polyline 1000 lb. minimum tensile strength pull string in each empty conduit except sleeves and nipples. This includes all raceways which do not have conductors furnished under this Division of the specifications. Pull cord must be fastened to prevent accidental removal.
- P. Use suitable caps to protect installed conduit against entrance of dirt and moisture.
- Q. Rigid steel box connections shall be made with double locknuts and bushings.
- R. Spare conduit stubs shall be capped and location and use marked with concrete marker set flush with finish grade. Marker shall be 6" round x 6" deep with appropriate symbol embedded into top to indicate use. Also, tag conduits in panels where originating.
- S. Spare conduit stubs shall be capped with a UL listed and accepted cap or plug for the specific intended use and identified with ink markers as to source and labeled "Spare."
- T. Conceal conduit and EMT within finished walls, ceilings, and floors, unless otherwise indicated.
- U. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.
- V. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors, including conductors smaller than No. 4 AWG.

- W. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb (90-kg) tensile strength. Leave at least 12 inches (300 mm) of slack at each end of pull wire.
- X. Install raceway sealing fittings at suitable, approved, and accessible locations and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings at the following points:
 - 1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
 - 2. Where otherwise required by NFPA 70.
- Y. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall.
- Z. All raceway runs in masonry shall be installed at the same time as the masonry so that no face cutting is required, except to accommodate boxes.
- AA. Raceways shall not be routed through stairwells, elevator shafts, elevator machine rooms or fire pump rooms unless the conduit is for use within that space.
- BB. Raceways installed in hazardous locations shall be installed in accordance with the appropriate provisions of NEC chapter 5 for that location. Confirm the appropriate space rating with life safety plans.
- CC. All raceway runs, whether terminated in boxes or not, shall be capped during the course of construction and until wires are pulled in, and covers are in place. No conductors shall be pulled into raceways until construction work which might damage the raceways has been completed.
- DD. Electrical raceways shall be supported independently of all other systems and supports, and shall in every case avoid proximity to other systems which might cause confusion with such systems or might provide a chance of electrolytic actions, contact with live parts or excessive induced heat.
- EE. Excavate trench bottom to provide firm and uniform support for conduit installed underground. Prepare trench bottom as specified in Division 31 Section "Earth Moving" for pipe less than 6 inches (150 mm) in nominal diameter. Install backfill as specified in Division 31 Section "Earth Moving."
- FF. After installing underground conduit, backfill and compact. Start at tie-in point, and work toward end of conduit run, leaving conduit at end of run free to move with expansion and contraction as temperature changes during this process. Firmly hand tamp backfill around conduit to provide maximum supporting strength. After placing controlled backfill to within 12 inches (300 mm) of finished grade, make final conduit connection at end of run and complete backfilling with normal compaction as specified in Division 31 Section "Earth Moving."

3.3 BOX INSTALLATION

- A. Set metal floor boxes level and flush with finished floor surface.
- B. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.

- C. Install electrical boxes as shown on drawings, and as required for splices, taps, wire pulling, equipment connections and compliance with regulatory requirements.
- D. Install electrical boxes to maintain headroom and to present neat mechanical appearance.
- E. Inaccessible Ceiling Areas: Install outlet and junction boxes no more than 6 inches (150 mm) from ceiling access panel or from removable recessed luminaire.
- F. Install boxes to preserve fire resistance rating of partitions and other elements.
- G. Align adjacent wall-mounted outlet boxes for switches, thermostats, and similar devices with each other.
- H. Outlets for 120V clocks shall be recessed so that the clock will hang flush with the finished surface of the wall.
- I. Use flush mounting outlet boxes in finished areas.
- J. Do not install flush mounting boxes back-to-back in walls; provide minimum 6 inch (150 mm) separation. Provide minimum 24 inches (600 mm) separation in acoustic and fire rated walls.
- K. Secure flush mounting box to interior wall and partition studs. Accurately position to allow for surface finish thickness.
- L. Use stamped steel bridges to fasten flush mounting outlet box between studs.
- M. Install flush mounting box without damaging wall insulation or reducing its effectiveness.
- N. Support all outlet boxes from structure with minimum of one (1) 3/8" all-thread rod hangers. Boxes larger than 25 square inches shall be supported with two (2) all-thread rod hangers, minimum.
- O. Do not fasten boxes to ceiling support wires.
- P. Use multi-gang box where more than one device is mounted together. Do not use sectional box.
- Q. Boxes in exterior walls shall be flush mounted. Use cast outlet box in exterior locations and wet locations where flush mounting is not possible.
- R. Install outlets in the locations shown on the drawings; however, the Owner shall have the right to make, prior to rough-in, slight changes in locations to reflect room furniture layouts.
- S. Coordinate work with all divisions so that each electrical box is the type suitable for the wall or ceiling construction provided and suitable fireproofing is inbuilt into fire rated walls.
- T. All boxes shall be installed in a flush rigid manner with box lines at perpendicular and parallel angles to finished surfaces. Boxes shall be supported by appropriate hardware selected for the type of surface from which the box shall be supported. For example, provide metal screws for metal, wood screws for wood, and expansion devices for masonry or concrete.
- U. For locations exposed to weather or moisture (interior or exterior), provide weatherproof boxes and accessories.

- V. As a minimum, provide pull boxes in all raceways over 150 feet long. The pull box shall be located near the midpoint of the raceway length.
 - W. Provide knockout closures to cap unused knockout holes where blanks have been removed, and plugs for unused threaded hubs.
 - X. Provide conduit locknuts and bushings of the type and size to suit each respective use and installation.
 - Y. Boxes and conduit bodies shall be located so that all electrical wiring is accessible.
 - Z. Avoid using round boxes where conduit must enter box through side of box, which would result in a difficult and insecure connection with a locknut or bushing on the rounded surface.
 - AA. All flush outlets shall be mounted so that covers and plates will finish flush with finished surfaces without the use of shims, mats or other devices not submitted or accepted for the purpose. Add-a-Depth rings or switch box extension rings are not acceptable. Plates shall not support wiring devices. Gang switches with common plate where two or more are indicated in the same location. Wall-mounted devices of different systems (switches, thermostats, etc.) shall be coordinated for symmetry when located near each other on the same wall. Outlets on each side of walls shall have separate boxes. Through-wall type boxes shall not be permitted. Back-to-back mounting shall not be permitted. Trim rings shall be extended to within 1/8" of finish wall surface.
 - BB. Outlet boxes mounted in metal stud walls, are to be supported to studs with two (2) screws inside of outlet box to a horizontal stud brace between vertical studs or one side of outlet box supported to stud with opposite side mounted to section of stud or device to prevent movement of outlet box after wall finished.
 - CC. All outlet boxes that do not receive devices in this contract are to have blank plates installed matching wiring device plates.
 - DD. Height of wall-mounted fixtures shall be as shown on the drawings or as required by Architectural plans and conditions. Fixture outlet boxes shall be equipped with fixture studs when supporting fixtures.
 - EE. Locate special purpose outlets as indicated on the drawings for the equipment served. Location and type of outlets shall be coordinated with appropriate trades involved. The securing of complete information for proper electrical roughing-in shall be included as work required under this section of specifications. Provide plug for each outlet.
 - FF. Electrical outlet boxes may be installed in vertical fire resistive assemblies classified as fire/smoke and smoke partitions without affecting the fire classification, provided such openings occur on one side only within a 24" wall space and that openings do not exceed 16 sq. inches. All clearances between such outlet boxes and the gypsum board must be completely filled with joint compound.
- 3.4 INSTALLATION OF UNDERGROUND HANDHOLES AND BOXES
- A. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting conduits to minimize bends and deflections required for proper entrances.

- B. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1/2-inch (12.5-mm) sieve to No. 4 (4.75-mm) sieve and compacted to same density as adjacent undisturbed earth.
- C. Elevation: In all areas, set so cover surface will be flush with finished grade.

3.5 INSTALLATION OF WIREWAYS

- A. Do not install wireways as a substitute for proper coordination and layout of conduit stub ups to panels. Prior authorization from the engineer is required prior to installation of any wireways.
- B. Do not make splices in wireways. All wires must be pulled through without splice or termination.
- C. Install wireway to maintain headroom and to present neat mechanical appearance.
- D. Support wireway independently of conduit.
- E. Wireway shall be located so that all electrical wiring is accessible.

END OF SECTION 26 05 33

SECTION 26 05 53 - IDENTIFICATION FOR ELECTRICAL 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. This Section includes the following:
 - 1. Identification for raceway and metal-clad cable.
 - 2. Identification for conductors and communication and control cable.
 - 3. Underground-line warning tape.
 - 4. Warning labels and signs.
 - 5. Instruction signs.
 - 6. Equipment identification labels.
 - 7. Miscellaneous identification products.

1.3 SUBMITTALS

- A. Product Data: For each electrical identification product indicated.
- B. Identification Schedule: An index of nomenclature of electrical equipment and system components used in identification signs and labels.
- C. Samples: For each type of label and sign to illustrate size, colors, lettering style, mounting provisions, and graphic features of identification products.

1.4 QUALITY ASSURANCE

- A. Comply with ANSI A13.1 and ANSI C2.
- B. Comply with NFPA 70.
- C. Comply with 29 CFR 1910.145.

1.5 COORDINATION

- A. Coordinate identification names, abbreviations, colors, and other features with requirements in the Contract Documents, Shop Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual, and with those required by codes, standards, and 29 CFR 1910.145. Use consistent designations throughout Project.
- B. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

- C. Coordinate installation of identifying devices with location of access panels and doors.
- D. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 RACEWAY, BOX AND METAL-CLAD CABLE IDENTIFICATION MATERIALS

- A. Snap-Around, Color-Coding Bands: Slit, pretensioned, flexible, solid-colored acrylic sleeves, 2 inches (50 mm) long, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.
- B. Primed and Painted band 4" in length.

2.2 CONDUCTOR AND COMMUNICATION- AND CONTROL-CABLE IDENTIFICATION MATERIALS

- A. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils (0.08 mm) thick by 1 to 2 inches (25 to 50 mm) wide.
- B. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.

2.3 UNDERGROUND-LINE WARNING TAPE

- A. Description: Permanent, bright-colored, continuous-printed, polyethylene tape.
 - 1. Not less than 6 inches (150 mm) wide by 4 mils (0.102 mm) thick.
 - 2. Compounded for permanent direct-burial service.
 - 3. Embedded continuous metallic strip or core.
 - 4. Printed legend shall indicate type of underground line.

2.4 WARNING LABELS AND SIGNS

- A. Comply with NFPA 70 and 29 CFR 1910.145.
- B. Baked-Enamel Warning Signs: Preprinted aluminum signs, punched or drilled for fasteners, with colors, legend, and size required for application. 1/4-inch (6.4-mm) grommets in corners for mounting. Nominal size, 7 by 10 inches (180 by 250 mm).
- C. Metal-Backed, Butyrate Warning Signs: Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs with 0.0396-inch (1-mm) galvanized-steel backing; and with colors, legend, and size required for application. 1/4-inch (6.4-mm) grommets in corners for mounting. Nominal size, 10 by 14 inches (250 by 360 mm).
- D. Warning label and sign shall include, but are not limited to, the following legends:
 - 1. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."

2. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES (915 MM)."

2.5 INSTRUCTION SIGNS

- A. Engraved, laminated acrylic or melamine plastic, minimum 1/16 inch (1.6 mm) thick for signs up to 20 sq. in. (129 sq. cm) and 1/8 inch (3.2 mm) thick for larger sizes.
 1. Engraved legend with black letters on white face.
 2. Punched or drilled for mechanical fasteners.
 3. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

2.6 EQUIPMENT IDENTIFICATION LABELS

- A. Safety Signs: Comply with 29 CFR, 1910.145.
- B. Nameplates shall be laminated phenolic plastic, chamfer edges.
 1. For 120/208 Volt System:
 - a. Black front and back with white core, with lettering etched through the outer covering. White engraved letters on Black background.
 2. For 277/480 Volt System:
 - a. Orange front and back with white core with lettering etched through the outer covering. White engraved letters on Orange background.
 3. For Emergency System:
 - a. Red front and back with white core with lettering etched through the outer covering. White engraved letters on red background.

2.7 MISCELLANEOUS IDENTIFICATION PRODUCTS

- A. Cable Ties: Fungus-inert, self-extinguishing, 1-piece, self-locking, Type 6/6 nylon cable ties.
 1. Minimum Width: 3/16 inch (5 mm).
 2. Tensile Strength: 50 lb (22.6 kg), minimum.
 3. Temperature Range: Minus 40 to plus 185 deg F (Minus 40 to plus 85 deg C).
 4. Color: Black, except where used for color-coding.
- B. Paint: Paint materials and application requirements are specified in Division 09 painting Sections.
- C. 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 INSTALLATION

- A. Identification Materials and Devices: Install at locations for most convenient viewing without interference with operation and maintenance of equipment.
- B. Lettering, Colors, and Graphics: Coordinate names, abbreviations, colors, and other designations with corresponding designations in the Contract Documents or with those required by codes and standards. Use consistent designations throughout Project.
- C. Sequence of Work: If identification is applied to surfaces that require finish, install identification after completing finish work.
- D. Self-Adhesive Identification Products: Clean surfaces before applying.
- E. Install painted identification according to manufacturer's written instructions and as follows:
 - 1. Clean surfaces of dust, loose material, and oily films before painting.
 - 2. Prime surfaces using type of primer specified for surface.
 - 3. Apply one intermediate and one finish coat of enamel.
- F. Caution Labels for Indoor Boxes and Enclosures for Power and Lighting: Install pressure-sensitive, self-adhesive labels identifying system voltage with black letters on orange background. Install on exterior of door or cover.
- G. Circuit Identification Labels on Boxes: Install labels externally.
 - 1. Exposed Boxes: Pressure-sensitive, self-adhesive plastic label on cover.
 - 2. Concealed Boxes: Plasticized card-stock tags.
 - 3. Labeling Legend: Permanent, waterproof listing of panel and circuit number or equivalent.
- H. Paths of Underground Electrical Lines: During trench backfilling, for exterior underground power, control, signal, and communication lines, install continuous underground line marker located directly above line at 6 to 8 inches below finished grade. Where width of multiple lines installed in a common trench or concrete envelope does not exceed 16 inches overall, use a single line marker. Install line marker for underground wiring, both direct-buried cables and cables in raceway.
- I. Secondary Service, Feeder, and Branch-Circuit Conductors: Color-code throughout the secondary electrical system.
 - 1. Color-code 208/120-V system as follows:
 - a. Phase A: Black.
 - b. Phase B: Red.
 - c. Phase C: Blue.
 - d. Neutral: White.
 - e. Ground: Green.
 - f. Switchlegs(load side of contactor or relay is not considered a switchleg): Purple
 - 2. Color-code 480/277-V system as follows:

- a. Phase A: Brown
 - b. Phase B: Orange
 - c. Phase C: Yellow
 - d. Neutral: White with a colored stripe or gray.
 - e. Ground: Green.
 - f. Switchleg(load side of contactor or relay is not considered a switchleg): Pink
3. Factory apply color the entire length of conductors, except the following field-applied, color-coding methods may be used instead of factory-coded wire for sizes larger than No. 6 AWG:
 - a. Colored, pressure-sensitive plastic tape in half-lapped turns for a 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. Use 1-inch wide tape in colors specified. Adjust tape bands to avoid obscuring cable identification markings.
- J. Power-Circuit Identification: Metal tags or aluminum, wraparound marker bands for cables, feeders, and power circuits in vaults, pull and junction boxes, manholes, and switchboard rooms.
1. Legend: 1/4-inch steel letter and number stamping or embossing with legend corresponding to indicated circuit designations.
 2. Tag Fasteners: Nylon cable ties.
 3. Band Fasteners: Integral ears.
- K. Apply identification to conductors as follows:
1. Conductors to Be Extended in the Future: Indicate source and circuit numbers.
 2. Multiple Power or Lighting Circuits in the Same Enclosure: Identify each conductor with source, voltage, circuit number, and phase. Use color-coding to identify circuits' voltage and phase.
 3. Multiple Control and Communication Circuits in the Same Enclosure: Identify each conductor by its system and circuit designation. Use a consistent system of tags, color-coding, or cable marking tape.
- L. Apply warning, caution, and instruction signs as follows:
1. Warnings, Cautions, and Instructions: Install to ensure safe operation and maintenance of electrical systems and of items to which they connect. Install engraved plastic-laminated instruction signs with approved legend where instructions are needed for system or equipment operation. Install metal-backed butyrate signs for outdoor items.
 2. Emergency Operation: Install engraved laminated signs with white legend on red background with minimum 3/8-inch high lettering for emergency instructions on power transfer, load shedding, and other emergency operations.
- M. 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.
- N. Instruction Signs:
1. Operating Instructions: Install instruction signs to facilitate proper operation and maintenance of electrical systems and items to which they connect. Install instruction

- signs with approved legend where instructions are needed for system or equipment operation.
2. Emergency Operating Instructions: Install instruction signs with white legend on a red background with minimum 3/8-inch- (10-mm-) high letters for emergency instructions at equipment used for power transfer.
- O. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and Operation and Maintenance Manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm systems unless equipment is provided with its own identification.
1. Labeling Instructions:
 - a. Engraved, laminated acrylic or melamine label. Unless otherwise indicated, provide a single line of text with 1/2-inch- (13-mm-) high letters on 1-1/2-inch- (38-mm-) high label; where 2 lines of text are required, use labels 2 inches (50 mm) high.
 - b. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.
 2. Equipment to Be Labeled: Include as a minimum the equipment identification (first line 1/2"): voltage rating and amperage rating (second line 3/8"): where it is fed from (third line 3/8"). (Example :Panel CP1 (Line 1), 208/120V 3ph, 4w, 225A(line 2), fed from swbd MDP-1 (Line 3))
 - a. Panelboards, electrical cabinets, and enclosures.
 - b. Access doors and panels for concealed electrical items.
 - c. Electrical switchgear and switchboards.
 - d. Transformers.
 - e. Electrical substations.
 - f. Emergency system boxes and enclosures.
 - g. Motor-control centers.
 - h. Disconnect switches.
 - i. Enclosed circuit breakers.
 - j. Motor starters.
 - k. Push-button stations.
- 3.2 SWITCHGEAR BREAKERS
- A. Provide labels for each breaker to identify the load served.
- 3.3 CONDUIT/JUNCTION BOX COLOR CODE
- A. All conduit system junction boxes (except those subject to view in public areas) shall be color coded as listed below:
 - B. Color Code for Junction Boxes
 1. System Emergency 277/480 volt Orange/Brown
 2. System Emergency 120/208 volt Orange/Black
 3. Fire Alarm Red

4.	Normal Power 277/480 volt	Brown
5.	Normal Power 120/208 volt	Black
6.	Fiber Optics	Purple
7.	Sound System	Yellow
8.	Clock	Light Blue
9.	Intercom	Blue
10.	Computer/Data	Gold
11.	TV	White
12.	Security/CCTV	Blue
13.	Ground	Fluorescent Green
14.	Telephone	Clover Green

- C. Conduits (not subject to public view) longer than 20 feet shall be painted with above color paint band 30 ft. on center. Paint band shall be 4" in length. Where conduits are parallel and on conduit racking, the paint bands shall be evenly aligned. Paint shall be neatly applied and uniformed. Paint boxes and raceways prior to installation or tape conduits and surrounding surfaces to avoid overspray. Paint overspray shall be removed.
- D. All new and existing junction boxes/cover plates for power, lighting and systems (except those installed in public areas) shall adequately describe it's associated panel and circuit reference number(s) within, (i.e. ELRW-2, 4, 6) or systems within (i.e. fire alarm, intercom. Etc.). Identification shall be by means of black permanent marker. (Paint ½ cover plate with appropriate color as noted in 2.3 above, and mark other ½ with associated panel/circuit or system description as described).

END OF SECTION 26 05 53

SECTION 26 24 16 - PANELBOARDS

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. 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. SPDT: Single pole, double throw.

1.4 REFERENCES

- A. NECA (National Electrical Contractors Association) "Standard of Installation."
- B. NEMA AB 1 - Molded Case Circuit Breakers.
- C. NEMA PB 1 - Panelboards.
- D. NEMA PB 1.1 - Instructions for Safe Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less.
- E. NFPA 70 - National Electrical Code.
- F. UL. 67 – Panelboards
- G. UL 50 Enclosures for Electrical Equipment
- H. UL 489 Molded Case Circuit Breakers and Circuit Breaker Enclosures
- I. Federal Specification W-P-115C-Type I Class I

- J. Federal Specification W-C-375B/GEN-Circuit Breakers, Molded Case, Branch Circuit and Service

1.5 SUBMITTALS

- A. Product Data: For each type of panelboard, overcurrent protective device, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.
- B. Shop Drawings: For each panelboard and related equipment.
 - 1. 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. UL listing for series rating of installed devices.
 - e. Features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
 - 2. Wiring Diagrams: Power, signal, and control wiring.
- C. Operation and Maintenance Data: For panelboards and components to include in operation and maintenance manuals. In addition to items specified in Division 01 Section "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.
 - 3. Panelboard Schedules: Submit final versions after load balancing.

1.6 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. Refer to Division 01 Section "Product Requirements."
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- D. Comply with NEMA PB 1.
- E. Comply with NFPA 70.
- F. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum ten years experience.

1.7 PROJECT CONDITIONS

- A. Environmental Limitations: Rate equipment for continuous operation under the environmental conditions that it will be permanently located.
- B. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:
 - 1. Notify Construction Manager no fewer than two days in advance of proposed interruption of electrical service.
 - 2. Do not proceed with interruption of electrical service without Construction Manager and Owner's written permission.

1.8 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Handle panelboards and enclosures carefully to prevent damage.
- B. Store equipment indoors and protect from weather.
- C. Deliver tubs and internal assemblies sufficiently in advance of installation period as necessary to prevent delay of work.

1.9 COORDINATION

- A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, 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 03.

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. Keys: Six spares for each type of panelboard cabinet lock.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Panelboards, Overcurrent Protective Devices, Controllers, Contactors, and Accessories:
 - a. Eaton Corporation; Cutler-Hammer Products.
 - b. General Electric Co.; Electrical Distribution & Protection Div.

- c. Siemens Energy & Automation, Inc.
- d. Square D.

2.2 MANUFACTURED UNITS

- A. Enclosures: Flush- and surface-mounted cabinets. NEMA PB 1, Type 1.
 - 1. Rated for environmental conditions at installed location.
 - a. Outdoor Locations: NEMA 250, Type 3R.
 - b. Kitchen Areas: NEMA 250, Type 4X, stainless steel.
 - c. Other Wet or Damp Indoor Locations: NEMA 250, Type 4X stainless steel.
 - d. Hazardous Areas Indicated on Drawings: NEMA 250, Type 7C.
 - 2. Front: Secured to box with concealed trim clamps. For surface-mounted fronts, match box dimensions; for flush-mounted fronts, overlap box. Provide with flush lock all keyed alike.
 - 3. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover ("door in door").
 - 4. Finish: Manufacturer's standard enamel finish over corrosion-resistant treatment or primer coat.
 - 5. Directory Card: With transparent protective cover, mounted in metal frame, inside panelboard door.
- 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.
 - 3. Isolated Equipment Ground Bus: Adequate for branch-circuit equipment ground conductors; insulated from box.
 - 4. Extra-Capacity Neutral Bus: Neutral bus rated 200 percent of phase bus and UL listed as suitable for nonlinear loads. For all panels serving computer loads or noted as 200% neutral.
- C. MAINS
 - 1. Provide main lug only (MLO) or main circuit breaker (MCB) as noted on drawings either by riser diagram or by schedule. Where conflict exists, provide MCB.
 - 2. Regardless of what is shown on drawings provide the following minimum requirements.
 - a. Main circuit breaker on each panel serving building main if required by applicable codes.
 - b. Main circuit breaker on each panel fed directly from a transformer (unless disconnect with overcurrent devices is installed in feeder between transformer and panel).
 - 3. Provide lugs as required for conductors being connected to panelboard lugs, circuit breakers, etc.
 - 4. Main circuit breaker is not to be mounted as branch breaker or subfeed breaker.
- D. Conductor Connectors: Suitable for use with conductor material.
 - 1. Main and Neutral Lugs: Mechanical type.

2. Ground Lugs and Bus Configured Terminators: Compression type.
 3. Feed-Through Lugs: Mechanical type suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.
 4. Extra-Capacity Neutral Lugs: Rated 200 percent of phase lugs mounted on extra-capacity neutral bus. For all panels serving computer loads or noted as 200% neutral.
- E. Service Equipment Label: UL labeled for use as service equipment for panelboards with main service disconnect switches.
- F. Future Devices: Mounting brackets, bus connections, and necessary appurtenances required for future installation of devices. This includes all bussing and hardware less the breaker.
- G. Provide lugs as required for conductors being connected to panelboard lugs, circuit breakers, etc.

2.3 PANELBOARD SHORT-CIRCUIT RATING

- A. UL label indicating series-connected rating with integral or remote upstream overcurrent protective devices. Include size and type of upstream device allowable, branch devices allowable, and UL series-connected short-circuit rating.

2.4 DISTRIBUTION PANELBOARDS

- A. Doors: 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-Breaker Frame Sizes 125 A and Smaller: Bolt-on circuit breakers.
 2. For Circuit-Breaker Frame Sizes Larger Than 125 A: Bolt-on circuit breakers; plug-in circuit breakers where individual positive-locking device requires mechanical release for removal.
 3. Fused switches.

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.
- C. Kitchen panel boards shall have surge protection integral to the panel. See SPD specification.

2.6 EQUIPMENT FOR ELECTRICITY METERING BY OWNER

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. E-Mon; a division of Hunt Power.
 2. Osaki Meter Sales, Inc.

3. Square D; a brand of Schneider Electric.

B. General Requirements for Owner's Meters:

1. Comply with UL 1244.
2. Memory Backup: Self-contained to maintain memory throughout power outages of 72 hours, minimum.
3. Sensors: Current-sensing type, with current or voltage output, selected for optimum range and accuracy for meters indicated for this application.
4. Building Automation System (BAS) Interface: Match signal to BAS input and arrange to convey the instantaneous, integrated, demand level measured by meter to provide data for processing.

C. Kilowatt-hour/Demand Meter: Electronic single- and three-phase meters, measuring electricity use and demand. Demand shall be integrated over a 15-minute interval.

1. Voltage and Phase Configuration: Meter shall be designed for use on circuits with voltage rating and phase configuration indicated for its application.
2. Display: LCD with characters not less than 0.25 inch high, indicating accumulative kilowatt-hours, current time and date, current demand, and historic peak demand, and time and date of historic peak demand.

2.7 OVERCURRENT PROTECTIVE DEVICES

A. Molded-Case Circuit Breaker: UL 489, with series-connected rating to meet available fault currents.

1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits. Adjustable electronic trip setting for circuit-breaker frame sizes 250 A and larger.
2. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
3. Electronic trip-unit circuit breakers shall have RMS sensing; field-replaceable rating plug; and 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.
4. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller; let-through ratings less than NEMA FU 1, RK-5.
5. Integrally Fused Circuit Breakers: Thermal-magnetic trip element with integral limiter-style fuse listed for use with circuit breaker; trip activation on fuse opening or on opening of fuse compartment door.
6. GFCI Circuit Breakers: Single- and two-pole configurations with 5-mA trip sensitivity.

B. Molded-Case Circuit-Breaker Features and Accessories: Standard frame sizes, trip ratings, and number of poles.

1. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor materials.
2. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HACR for heating, air-conditioning, and refrigerating equipment.

3. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
4. Shunt Trip: 120-V trip coil energized from separate circuit, set to trip at 75 percent of rated voltage.
5. Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage with field-adjustable 0.1- to 0.6-second time delay.
6. Key Interlock Kit: Externally mounted to prohibit circuit-breaker operation; key shall be removable only when circuit breaker is in off position.
7. Multipole units enclosed in a single housing or factory-assembled to operate as a single unit.

2.8 COORDINATION STUDY

- A. Manufacturer shall provide a coordination study and Arc flash labeling in accordance with section 26 05 73 to coordinate the tripping of overcurrent protective devices for all new switchboards, distribution boards and panel boards supplied as part of this project. Provide settings of all adjustable trip breakers and confirm that non-adjustable trip breakers are properly coordinated to provide tripping of smaller breakers before the tripping of larger breakers. If non-adjustable trip breakers will not coordinate properly with the upstream breaker, an adjustable trip breaker will be provided to coordinate properly at no additional cost to the Owner. All breakers provided shall provide the correct interrupting capacity required or series protection required to protect the distribution system from faults.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install panelboards and accessories according to NEMA PB 1.1.
- B. Install all panelboards and panelboard enclosures in accordance with the manufacturer's written instructions, NECA's "Standard of Installation", the applicable requirements of the National Electrical Code, and recognized industry practices.
- 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. Stub four 1-inch (27-GRC) empty conduits from flush panelboards into accessible ceiling space or space designated to be ceiling space in the future.
- G. Arrange conductors in gutters into groups and bundle and wrap with wire ties after completing load balancing.
- H. Provide typed circuit directory for each branch circuit panelboard. Mount a typewritten directory showing the actual circuit numbers, type of load and room names/numbers on inside of door. Room names/numbers shall be actual names or numbers used, not necessarily shown on the drawings. Any directory that does not facilitate determination of exactly what room(s) and what

load(s) are on a circuit shall be corrected prior to request for substantial completion. Progress Drawings shall show same arrangements as the Directory. Revise directory to reflect circuiting changes required to balance phase loads.

- I. Proper working clearances shall be maintained at every panelboard location. The working space in front of a panelboard shall be as a minimum, 30 inches wide extending 3 feet, 3.5 feet, or 4 feet (per NEC) out perpendicular to the panelboard.
- J. All enclosures shall be firmly anchored to walls and supporting structures (where used) using appropriate hardware. Provide supporting (unistrut type) channels on walls constructed of gypsum board or where otherwise necessary to provide a mechanically secure and permanent installation. Enclosures shall be installed so that the top is 6'-6" above finished floor. Where the size of the enclosure is such that the top cannot be installed at 6'-6", the top of the enclosure shall be kept as low as possible.
- K. Sub-Metering shall be provide on the Kitchen Panelboards with capability of monitoring of the Panelboards entire load by OCPS EMS (whether shown on drawings or not). Coordinate interface with DG 23 09 23 Direct Digital Control for HVAC Systems. Metering devices will be flush mounted next to Panelboard being monitored. Metering devices shall be similar to Emon.
- L. Sub-Metering shall be provided for Lighting Panelboards that serve the lighting in the Kitchen and Cafeteria areas (whether shown on drawings or not). Panelboards with capability of monitoring of the Panelboards individual circuits/loads by OCPS EMS. Coordinate interface with DG 23 09 23 Direct Digital Control for HVAC Systems. Metering devices will be surface mounted in electrical room next to Panelboard being monitored. Metering devices shall be similar to Emon.
- M. Coordinate all raceways and conductors with their respective panelboards so that all connections and conductors routing present an orderly appearance. Conductors in the panelboards shall be laced and arranged in orderly manner.

3.2 IDENTIFICATION

- A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs as specified in Division 26 Section "Identification for Electrical Systems."
- B. Create a directory to indicate installed circuit loads after balancing panelboard loads. Obtain approval before installing. Use a computer or typewriter to create directory; handwritten directories are not acceptable.
- C. Panelboard Nameplates: Label each panelboard with engraved metal or laminated-plastic nameplate mounted with corrosion-resistant screws.
- D. Nameplate shall state panel name, voltage and name of panel that feeds this respective panel, UL short-circuit rating.

3.3 CONNECTIONS

- A. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."
- B. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

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 26 24 16

SECTION 26 27 26 - WIRING DEVICES

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. Receptacles, receptacles with integral GFCI, and associated device plates.
 - 2. Twist-locking receptacles.
 - 3. Isolated-ground receptacles.
 - 4. Snap switches and wall-box dimmers.
 - 5. Solid-state fan speed controls.
 - 6. Pendant cord-connector devices.
 - 7. Cord and plug sets.
 - 8. 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. Pigtail: Short lead used to connect a device to a branch-circuit conductor.
- D. RFI: Radio-frequency interference.
- E. TVSS: Transient voltage surge suppressor.
- F. UTP: Unshielded twisted pair.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Operation and Maintenance Data: For wiring devices to include in all manufacturers' packing label warnings and instruction manuals that include labeling conditions.

1.5 QUALITY ASSURANCE

- A. Source Limitations: Obtain each type of wiring device and associated wall plate through one source from a single manufacturer. Insofar as they are available, obtain all wiring devices and associated wall plates from a single manufacturer and one source.
- 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. Comply with NEMA WD 1.

1.6 COORDINATION

- A. Receptacles for Owner-Furnished Equipment: Match plug configurations.
 - 1. Cord and Plug Sets: Match equipment requirements.

1.7 ALLOWANCES

- A. Provide for twenty additional receptacles as directed in field. Allowance includes purchase, delivery and installation of box, receptacle cover plate, wire and 100 feet of conduit for each receptacle.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers' Names: Shortened versions (shown in parentheses) of the following manufacturers' names are used in other Part 2 articles:
 - 1. Hubbell Incorporated; Wiring Device-Kellems (Hubbell).
 - 2. Leviton Mfg. Company Inc. (Leviton).
 - 3. Pass & Seymour/Legrand; Wiring Devices & Accessories (Pass & Seymour).

2.2 STRAIGHT BLADE RECEPTACLES

- A. Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, and UL 498.
 - 1. Products: Subject to compliance with requirements, provide one of the following for standard convenience outlets:
 - a. Hubbell; HBL5361 (single), HBL5352 (duplex).
 - b. Leviton; 5351 (single), 5352 (duplex).
 - c. Pass & Seymour; 5361 (single), 5352 (duplex).

2. Black Computer Power Duplex Receptacle:
 - a. Pass & Seymour Model PS5352-Black
 - b. Hubbell Model HBL5362-Black
 - c. Leviton Model 5362-Black

2.3 GFCI RECEPTACLES

- A. General Description: Straight blade, feed-through type. Comply with NEMA WD 1, NEMA WD 6, UL 498, and UL 943, Class A, and trip button to indicate when device is tripped. Face will not have power if reverse wired. Visual indication for device has lost capability to provide protection.
- B. Outdoor locations provide weather resistant GFCI convenience receptacles, 125V, 20A - Black
 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Hubbell #GFR5362WR
 - b. Pass & Seymour; 2095DSWRBK.
 - c. Leviton #W7899-E
- C. Duplex GFCI Convenience Receptacles, 125 V, 20 A:
 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Hubbell #GFR5362
 - b. Pass & Seymour; 2095.
 - c. Leviton #6898

2.4 HAZARDOUS (CLASSIFIED) LOCATION RECEPTACLES

- A. Wiring Devices for Hazardous (Classified) Locations: Comply with NEMA FB 11 and UL 1010.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Cooper Crouse-Hinds.
 - b. EGS/Appleton Electric.
 - c. Killark; a division of Hubbell Inc.

2.5 TWIST-LOCKING RECEPTACLES

- A. Single Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration L5-20R, and UL 498.
 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Hubbell; HBL2310.
 - b. Leviton; 2310.
 - c. Pass & Seymour; L520-R.

2.6 PENDANT CORD-CONNECTOR DEVICES

- A. Description: Matching, locking-type plug and receptacle body connector; NEMA WD 6 configurations L5-20P and L5-20R, 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.

2.7 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.

2.8 SNAP SWITCHES

- A. Comply with NEMA WD 1 and UL 20.
- B. Snap switches for general use shall be maintained contact types, and shall be single-pole, double-pole, three-way, or four-way as required for the specific switching arrangements shown on the drawings. They shall be quiet tumbler operation types, having silver alloy contacts, and meeting all NEMA performance standards.
- C. Switches, 120/277 V, 20 A:
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Hubbell; HBL1221 (single pole), HBL1222 (two pole), HBL1223 (three way), HBL1224 (four way).
 - b. Leviton; 1221 (single pole), 1222 (two pole), 1223 (three way), 1224 (four way).
 - c. Pass & Seymour; PS20AC1 (single pole), PS20AC2 (two pole), PS20AC3 (three way), PS20AC4 (four way).
- D. Pilot Light Switches, 20 A:
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Hubbell; HPL1221PL for 120 V and 277 V.
 - b. Leviton; 1221-PLR for 120 V, 1221-7PLR for 277 V.
 - c. Pass & Seymour; PS20AC1RPL for 120 V.
 2. Description: Single pole, with neon-lighted handle, illuminated when switch is "off." Provide red handle for switches connected to emergency power.

- E. Key-Operated Switches, 120/277 V, 20 A:
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Hubbell; HBL1221L.
 - b. Leviton; 1221L.
 - c. Pass & Seymour; PS20AC1-L.
 - 2. Description: Single pole, with factory-supplied key in lieu of switch handle. All key operated switches shall be keyed alike.
- F. Single-Pole, Double-Throw, Momentary Contact, Center-Off Switches, 120/277 V, 20 A; for use with mechanically held lighting contactors.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Hubbell; HBL1557.
 - b. Leviton; 1257.
 - c. Pass & Seymour; 1251.
- G. Key-Operated, Single-Pole, Double-Throw, Momentary Contact, Center-Off Switches, 120/277 V, 20 A; for use with mechanically held lighting contactors, with factory-supplied key in lieu of switch handle. All keyed switches shall be keyed alike.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Hubbell; HBL1557L.
 - b. Leviton; 1257L.
 - c. Pass & Seymour; 1251L.

2.9 WALL-BOX DIMMERS

- A. Dimmer Switches: Modular, full-wave, solid-state units with integral, quiet on-off switches, with audible frequency and EMI/RFI suppression filters.
- B. Control: Continuously adjustable toggle switch; with single-pole or three-way switching. Comply with UL 1472.
- C. Incandescent Lamp Dimmers: 120 V; control shall follow square-law dimming curve. On-off switch positions shall bypass dimmer module.
 - 1. 600 W; dimmers shall require no derating when ganged with other devices.
- D. Fluorescent Lamp Dimmer Switches: Modular; compatible with dimmer ballasts; trim potentiometer to adjust low-end dimming; dimmer-ballast combination capable of consistent dimming with low end not greater than 20 percent of full brightness.

2.10 FAN SPEED CONTROLS

- A. Modular, 120-V, full-wave, solid-state units with integral, quiet on-off switches and audible frequency and EMI/RFI filters. Comply with UL 1917.

1. Continuously adjustable toggle switch, 5 A.
2. Three-speed adjustable slider, 1.5 A.

2.11 WALL PLATES

- A. Single and combination types to match corresponding wiring devices.
1. Plate-Securing Screws: Metal with head color to match plate finish.
 2. All wiring devices shall be provided with standard size one-piece cover plates of suitable configuration for the number and type of devices to be covered.
 3. Metallic cover plates shall be used in interior spaces, except as noted below, and shall be fabricated of corrosion-resistant #302 stainless steel, having a nominal thickness of .04", and a brushed finish. Screws securing the plates shall have flush (when installed) heads with finish to match plates. Metallic cover plates shall meet all requirements of the National Electrical Code and Federal Specifications.
 4. Cover plates for switches located in corrosive atmospheres (where vaporproof is not indicated) shall be equal to Hubbell #17CM81/#17CM82/#17CM83/#17CM84 one piece neoprene with matching pressswitch.
 5. Cover plate engraving, where required, shall be accomplished by cover plate manufacturer in accordance with instructions given on the drawings. Metallic plates shall be engraved with black fill. Red plates shall be engraved with white fill.
 6. Material for Unfinished Spaces: Galvanized steel.
- B. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with type 3R weather-resistant, die-cast aluminum with lockable "in use" cover. Cover plates for exterior receptacles shall be gasketed covers with hinge allowing plug and cord to be plugged in and activated with cover closed..

2.12 MULTIOUTLET ASSEMBLIES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Hubbell Incorporated; Wiring Device-Kellems.
 2. Wiremold Company (The).
 3. Mono-systems, Inc.
- B. Components of Assemblies: Products from a single manufacturer designed for use as a complete, matching assembly of raceways and receptacles.
- C. Raceway Material: Metal, with manufacturer's standard finish.
- D. Wire: No. 12 AWG.

2.13 SERVICE POLES

- A. Description: Factory-assembled and -wired units to extend power and voice and data communication from distribution wiring concealed in ceiling to devices or outlets in pole near floor.

1. Poles: Nominal 2.5-inch- (65-mm-) square cross section, with height adequate to extend from floor to at least 6 inches (150 mm) above ceiling, and with separate channels for power wiring and voice and data communication cabling.
2. Mounting: Ceiling trim flange with concealed bracing arranged for positive connection to ceiling supports; with pole foot and carpet pad attachment.
3. Finishes: Manufacturer's standard painted finish and trim combination.
4. Wiring: Sized for minimum of five No. 12 AWG power and ground conductors and a minimum of four, 4-pair, Category 3 or 5 voice and data communication cables.
5. Power Receptacles: Two duplex, 20-A, heavy-duty, NEMA WD 6 configuration 5-20R units.
6. Voice and Data Communication Outlets: Four RJ-45 Category 6 jacks.

2.14 FINISHES

- A. Color: Wiring device catalog numbers in Section Text do not designate device color.
1. Wiring Devices Connected to Normal Power System: Gray, unless otherwise indicated or required by NFPA 70 or device listing.
 2. Receptacle devices for computer power shall be black color.
 3. Wiring Devices Connected to Emergency Power System: Red.
 4. Modify any given catalog numbers as required to procure devices and plates of the proper color.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Coordination with Other Trades:
1. Take steps to insure that devices and their boxes are protected. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of the boxes.
 2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
 3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
 4. Install wiring devices after all wall preparation, including painting, is complete.
- B. Install products in accordance with manufacturer's instructions.
- C. Install devices plumb and level.
- D. Install switches with OFF position down.
- E. Provide device coverplates for every device installed. Cover plates shall be installed so that they appear straight with no gaps between plate edges and the wall. Maintain vertical and horizontal to within 1/16 of an inch
- F. Wiring devices shall not be installed in exposed masonry until cleaning of masonry with acids has been completed.

- G. All receptacles and switches shall be grounded by means of a ground wire from device ground screw to outlet box screw and branch circuit ground conductor. Strap alone will not constitute an acceptable ground.
- H. All devices shall be installed so that only one wire is connected to each terminal.
- I. Connect wiring devices by wrapping conductor around screw terminal.
- J. Install galvanized steel plates on outlet boxes and junction boxes in unfinished areas, above accessible ceilings, and on surface mounted outlets.
- K. Install local room area wall switches at door locations on the lock side of the door, approximately four inches from the jamb. Where locations shown on the drawings are in question, provide written request for information to A/E prior to roughin.
- L. Conductors:
 - 1. Do not strip insulation from conductors until just before they are spliced or terminated on devices.
 - 2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
 - 3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.
- M. Device Installation:
 - 1. Replace all devices that have been in temporary use during construction or that show signs that they were installed before building finishing operations were complete.
 - 2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
 - 3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
 - 4. Connect devices to branch circuits using pigtails that are not less than 6 inches (152 mm) in length.
 - 5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, 2/3 to 3/4 of the way around terminal screw.
 - 6. Use a torque screwdriver when a torque is recommended or required by the manufacturer.
 - 7. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
 - 8. Tighten unused terminal screws on the device.
 - 9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device mounting screws in yokes, allowing metal-to-metal contact.
- N. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.
- O. Dimmers:
 - 1. Install dimmers within terms of their listing.
 - 2. Verify that dimmers used for fan speed control are listed for that application.
 - 3. Install unshared neutral conductors on line and load side of dimmers according to manufacturers' device listing conditions in the written instructions.

- P. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on bottom. Group adjacent switches or receptacles under multigang wall plates. Provide proper NEC barriers in boxes which serve devices for both the Normal and Emergency Systems.
- Q. Adjust locations of floor service outlets and service poles to suit arrangement of partitions and furnishings.

3.2 CONNECTIONS

- A. Connect wiring device grounding terminal to outlet box with bonding jumper.
- B. Connect wiring device grounding terminal to branch-circuit equipment grounding conductor.
- C. Tighten electrical connectors and terminals according to manufacturers published torque-tightening values. If manufacturers torque values are not indicated, use those specified in UL 486A and UL 486B.

3.3 NEUTRAL CONDUCTOR CONNECTIONS

- A. At each receptacle "in" and "out" phase and neutral conductors shall have an additional conductor for connection to device. The practice of "looping" conductors through receptacle boxes shall not be acceptable. (IE: The device shall not be used to complete the circuit. Pigtails shall be used from the device)

3.4 IDENTIFICATION

- A. Comply with Division 26 Section "Identification for Electrical Systems."
 - 1. Receptacles and Switches: Identify panelboard and circuit number from which served. Use permanent marker to identify on the back of plates or tags within outlet boxes.

3.5 FIELD QUALITY CONTROL

- A. Inspect each wiring device for defects.
- B. Operate each wall switch with circuit energized and verify proper operation.
- C. Verify that each receptacle device is energized.
- D. Test each receptacle device for proper polarity.
- E. Test each GFCI receptacle device for proper operation.

3.6 ADJUSTING

- A. Adjust devices and wall plates to be flush and level.

END OF SECTION 26 27 26

SECTION 26 41 13 - LIGHTNING PROTECTION FOR STRUCTURES

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 a UL Master Labeled lightning protection system for buildings, building elements, and building site components.

1.3 DEFINITIONS

- A. LPI: Lightning Protection Institute.
- B. NRTL: National recognized testing laboratory.

1.4 SUBMITTALS

- A. Product Data: For air terminals and mounting accessories.
- B. Shop Drawings: Detail lightning protection system, including air-terminal locations, conductor routing and connections, and bonding and grounding provisions. Include indications for use of raceway, data on how concealment requirements will be met, and calculations required by NFPA 780 for bonding of grounded and isolated metal bodies.
- C. Qualification data for firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include data on listing or certification by an NRTL or LPI.
- D. Certification, that roof adhesive for air terminals is approved by manufacturers of both the terminal assembly and the single-ply membrane roofing material.
- E. Operation and Maintenance Data: For Lightning Protection System to include in operation, and maintenance manuals. In addition to items specified in Division 1 Section "Operation and Maintenance Data," include the following:
 - 1. UL Master Label Certification for each building.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an experienced installer who is an NRTL or who is certified by LPI as a Master Installer/Designer.
- B. Listing and Labeling: As defined in NFPA 780, "Definitions" Article.
- C. Provide UL Master Label.

1.6 COORDINATION

- A. Coordinate installation of lightning protection with installation of other building systems and components, including electrical wiring, supporting structures and building materials, metal bodies requiring bonding to lightning protection components, and building finishes.
- B. Coordinate installation of air terminals attached to roof systems with roofing manufacturer and Installer.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. ERICO International Corporation.
 - 2. Harger Lightning Protection, Inc.
 - 3. Heary Bros. Lightning Protection Co. Inc.
 - 4. Independent Protection Co.
 - 5. Robbins Lightning Inc.
 - 6. Thompson Lightning Protection, Inc.

2.2 LIGHTNING PROTECTION SYSTEM COMPONENTS

- A. Comply with UL 96.
- B. Roof-Mounting Air Terminals: NFPA Class I, aluminum, solid, unless otherwise indicated.
 - 1. ½" diameter manufactured from highly conductive aluminum with ½" UNC threads. Terminal tip shall be a minimum of 10" above the object or area it is to protect.
 - 2. Single-Membrane, Roof-Mounting Air Terminals: Designed for single-membrane roof materials.
 - 3. Modified Bitumen, Roof-Mounting Air Terminals: Designed for modified bitumen roof materials.
 - 4. Utilize terminals specifically manufactured for standing seam metal roofs when installed on this type of roof.

5. Parapet mounted terminals: Designed to extend with offset base beyond parapet cap and extend a minimum of 10" above the top of the wall cap.
- C. Ground Rods, Ground Loop Conductors, and Concrete-Encased Electrodes: Comply with Division 26 Section "Grounding and Bonding for Electrical Systems" and with standards referenced in this Section.
- D. Roof main conductors shall be aluminum 95lb/1000ft, 14AWG strand, 98,600 circular mils minimum. Copper down conductor shall be copper 187lb/1000ft, 17AWG strand, 57,400 circular mil minimum. Transition from copper to aluminum shall be via an approved bimetallic connector.
- E. Cable Fasteners: Electrolytically compatible with the conductor and mounting surface.
- F. Bonding Devices, Cable Splicers and Miscellaneous Connectors: Cast bronze with bolt pressure connections to the cable for all above ground connections. Exothermic welded connection for all below ground connections. Cast or stamped crimp fittings are not acceptable.
- G. Thru roof assemblies shall be equivalent to Harger 230 Series. Pre-manufactured assemblies consisting of a base plate/cable connector, threaded riser bar, 2 3/8" OD PVC tubing support, and cap/cable connector. Base plate/cable connector and cap/cable connector to be designed to tightly nest with and capture support tube preventing lateral displacement of assembly.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install lightning protection components and systems according to UL 96A and NFPA 780.
- B. Install conductors with direct paths from air terminals to ground connections. Avoid sharp bends and narrow loops.
- C. Conceal the following conductors:
 1. System conductors.
 2. Down conductors.
 3. Interior conductors.
 4. Conductors within normal view from exterior locations at grade within 200 feet (60 m) of building.
 5. Notify Architect at least 48 hours in advance of inspection before concealing lightning protection components.
- D. Cable Connections: Use approved exothermic-welded connections for all conductor splices and connections between conductors and other components below grade. Utilize a torque wrench to properly tighten all above grade bolted connections. Tighten in accordance with manufacturers instructions.

- E. Air Terminals on membrane roofing: Comply with adhesive manufacturer's written instructions.
- F. All connections to roof (terminals and cable) shall be provided with a sacrificial roof pad at all locations.
- G. Bond extremities of vertical metal bodies exceeding 60 feet (18 m) in length to lightning protection components.
- H. A counterpoise installation based on requirements in Division 26 Section "Grounding and Bonding for Electrical Systems" may be used as a ground loop required by NFPA 780, provided counterpoise conductor meets or exceeds minimum requirements in NFPA 780.
 - 1. Bond ground terminals to counterpoise conductor.
 - 2. Bond grounded metal bodies on building within 12 feet (3.6 m) of ground to counterpoise conductor.
 - 3. Bond grounded metal bodies on building within 12 feet (3.6 m) of roof to interconnecting loop at eave level or above.
- I. Bond lightning protection components with intermediate-level interconnection loop conductors to grounded metal bodies of building at 60-foot (18-m) intervals.
- J. The entire installation shall provide protection from allowing water intrusion into the building envelope.

3.2 CORROSION PROTECTION

- A. Do not combine materials that can form an electrolytic couple that will accelerate corrosion in the presence of moisture unless moisture is permanently excluded from junction of such materials.
- B. Use conductors with protective coatings where conditions would cause deterioration or corrosion of conductors.
- C. All components in direct contact with earth shall be copper.

3.3 FIELD QUALITY CONTROL

- A. UL Inspection: Provide inspections as required to obtain a UL Master Label for system.

END OF SECTION 26 41 13

SECTION 26 43 13 – SURGE PROTECTION DEVICES

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. Surge Protection Devices (SPD) includes all electrical systems and devices specifically installed in facility electrical systems to protect all electrical circuits, electronic equipment and building mechanical systems from the effects of lightning induced voltages, external switching transients and internally generated switching transients.

1.3 APPLICATION

- A. Surge suppression, grounding and bonding shall effectively protect the systems to which they are applied against lightning, transients, internal spikes, and other surge transients throughout the useful life of the systems, and shall be designed and installed in such a manner that normal operation, performance ratings and listing of the system is not impaired by the installation of such devices, wiring or connections.
- B. Surge suppression devices shall be installed on all service entrance equipment (to include distribution panels and panelboards in separate buildings that perform the function of service entrance equipment for that particular building), distribution panels, lighting and appliance panelboards that may feed any electronic equipment (to include personal computers, copiers, printers, fire alarm panels, building management systems, intercom systems, etc.) and any circuits leaving the building; e.g. outdoor lighting and all signal circuits (data, telephone, fire alarm, intercom, etc.) leaving or entering a building.

1.4 DEFINITIONS

- A. ATS: Acceptance Testing Specifications.
- B. VPR: Voltage protection rating.
- C. SPD: Surge Protection Devices

1.5 SUBMITTALS

- A. Product Data: For each type of product indicated. Include rated capacities, operating weights, operating characteristics, furnished specialties, and accessories.
- B. General: SPD wiring, bonding and grounding connections shall be indicated on the wiring diagrams for each system. Include installation details demonstrating mechanical and electrical connections to equipment to be protected.
- C. Testing: The test data submitted shall be specific for the actual method on installation proposed. Submittals will not be reviewed unless they include proper project related data. Interpretation of standard manufacturer's published data will not be acceptable unless the data coincides with the actual installation procedure.
- D. Manufacturer's certified test data indicating the ability of the product to meet or exceed requirements of this specification, including 10 x 1000 μ s recognized independent lab testing.
- E. List and detail all protection systems such as fuses, disconnecting means and protective materials.
- F. Product Certificates: For SPD signed by product manufacturer certifying compliance with the following standards:
 - 1.
 - 2. UL 1449 3rd Edition
- G. Operation and Maintenance Data: For SPD to include in operation, and maintenance manuals.
- H. Warranties: Special warranties specified in this Section.

1.6 REFERENCE STANDARDS AND PUBLICATIONS

- A. ANSI/IEEE C62.33 - Standard for Test Specifications for Varistor Surge Protection Devices
- B. ANSI/IEEE C62.35 - Standard for Test Specification for Avalanche Junction Semiconductor Surge Protective Devices
- C. ANSI/IEEE C62.36 IEEE Standard for Test Methods for Surge Protectors Used in Low-Voltage AC Power Circuits
- D. ANSI/IEEE C62.41 2002 Guide for Surge Voltages in Low-Voltage AC Power Circuits Categories A, B, & C and Table 8, High Exposure 10 x 1000 μ s waveform testing
- E. ANSI/IEEE C62.45 2002 Guide on Surge Testing for Equipment Connected Low Voltage AC Power Circuits
- F. IEEE Standard 142 Recommended Practice for Grounding

- G. IEEE Standard 518 Recommended Guide on Electrical Noise
- H. IEEE Standard 1100 Recommended Practice for Powering and Grounding Electronic Equipment
- I. UL 1283 Standard for Safety Electromagnetic Interference Filters
- J. UL 1449, 3rd Edition, Standard for Surge Protective Devices
- K. NFPA 70 National Electrical Code
- L. NFPA 75 Standard for the Protection of Electronic Computer/Data Processing Equipment
- M. NFPA 780 Standard for the Installation of Lightning Protection Systems
- N. Military Standard 220A
- O. Federal Information Processing Standards (FIPS) Publication 94
- P. CCITT Rec. K-I 7 Waveform Specification for Electronic Systems

1.7 QUALITY ASSURANCE

- A. Source Limitations: Obtain suppression devices and accessories through one source from a single manufacturer.
- B. Product Options: Drawings indicate size, dimensional requirements, and electrical performance of suppressors and are based on the specific system indicated. Refer to Division 01 Section "Product Requirements."
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- D. Comply with IEEE C62.41, "IEEE Guide for Surge Voltages in Low Voltage AC Power Circuits," and test devices according to IEEE C62.45, "IEEE Guide on Surge Testing for Equipment Connected to Low-Voltage AC Power Circuits."
- E. Comply with UL 1449 3rd Edition, "Safety Standard for Surge Protection Devices"

1.8 MANUFACTURER QUALIFICATIONS

- A. Manufacturer: Company specializing in surge suppression equipment of the type herein specified with a minimum ten years documented experience.
- B. Repair: The surge protection device manufacturer shall offer factory repair service and/or replacement for all units. The manufacturer shall provide this service within four working days and provide replacement components shipped to the Owner for installation within the allocated response time.

- C. Installation Certification: Submit in the close out documents a letter from the surge protection manufacturer stating that the installation has been inspected by the manufacturer or the manufacturer's representative. The certification letter must state that the installation has been done in accordance with the manufacturers requirements and the warranty is in effect. Submit five copies to the Engineer for review.

1.9 PROJECT CONDITIONS

- A. Service Conditions: Rate surge protection devices for continuous operation under the following conditions, unless otherwise indicated:
 - 1. Maximum Continuous Operating Voltage: Not less than 115 percent of nominal system operating voltage.
 - 2. Operating Temperature: 30 to 120 deg F (0 to 50 deg C).
 - 3. Humidity: 0 to 85 percent, noncondensing.
 - 4. Altitude: Less than 20,000 feet (6090 m) above sea level.

1.10 COORDINATION

- A. Coordinate location of field-mounted surge suppressors to allow adequate clearances for maintenance.

1.11 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of surge suppressors that fail in materials or workmanship within ten years from date of Substantial Completion.
- B. Replacement: Any suppressor which shows evidence of failure or incorrect operation during the warranty period shall be repaired or replaced at no expense to the Owner including labor and materials. Since "Acts of Nature" or similar statements include the lightning threat to which these suppression devices shall be exposed, any such clause limiting warranty responsibility in the general conditions of this specification shall not apply to this section. The warranty shall cover the entire device.
- C. Installation: Installation of SPDs on electrical distribution equipment shall in no way compromise or violate equipment listing, labeling, or warranty of the distribution equipment.

PART 2 - PRODUCTS

2.1 SERVICE ENTRANCE SUPPRESSORS

- A. Surge Protection Device Description: Modular design with field-replaceable modules, sine-wave-tracking type with the following features and accessories:
 - 1. Fabrication using bolted compression lugs for internal wiring.
 - 2. Redundant replaceable modules.
 - 3. Arrangement with wire connections to phase buses, neutral bus, and ground bus.

4. LED indicator lights for power and protection status.
 5. Audible alarm, with silencing switch, to indicate when protection has failed.
 6. One set of dry contacts rated at 5 A and 250-V ac, for remote monitoring of protection status. Coordinate with building power monitoring and control system.
- B. Peak Single-Impulse Surge Current Rating: 240 kA per phase.
- C. SPD shall be type 2 rated 20KA or more nominal discharge current (In) and labeled for lightning protection installations.
- D. Connection Means: Permanently wired.
- E. Protection modes and UL 1449 VPR for grounded wye circuits with voltages of 480Y/277, 208Y/120, 3-phase, 4-wire circuits shall be as follows:
1. Line to Neutral: 1200 V for 480Y/277: 600 V for 208Y/120.
 2. Line to Ground: 1200 V for 480Y/277: 600 V for 208Y/120.
 3. Neutral to Ground: 1200 V for 480Y/277: 600 V for 208Y/120.
- F. Protection modes and UL 1449 VPR for 240/120-V, single-phase, 3-wire circuits shall be as follows:
1. Line to Neutral: 600 V.
 2. Line to Ground: 600 V.
 3. Neutral to Ground: 600 V.
- G. Protection modes and UL 1449 VPR for 240/120-V, 3-phase, 4-wire circuits with high leg shall be as follows:
1. Line to Neutral: 600 V, 800 V from high leg.
 2. Line to Ground: 600 V.
 3. Neutral to Ground: 600 V.
- H. Short Circuit Withstand Rating: The device shall have a short circuit withstand rating identical or higher than the equipment that it is connected. Rating shall be permanently marked on the device.
- I. Power Interruption: During normal suppression operation, the unit shall not short circuit or crowbar the power flow that would result in an interruption to the load. Building power shall not require interruption for maintenance.
- J. Approved manufacturers:
1. LEA International
 2. Advanced Protection Technologies
 3. Liebert
 4. PQ Protection
 5. Switchgear manufacturer

2.2 PANELBOARD SUPPRESSORS

- A. Surge Protection Device Description: Non-modular, sine-wave-tracking type with the following features and accessories:
1. LED indicator lights for power and protection status.

- B. Peak Single-Impulse Surge Current Rating: 80 kA per phase.
- C. Protection modes and UL 1449 VPR for grounded wye circuits with voltages of 480Y/277, 208Y/120, 3-phase, 4-wire circuits shall be as follows:
 - 1. Line to Neutral: 1200 V for 480Y/277: 600 V for 208Y/120.
 - 2. Line to Ground: 1200 V for 480Y/277: 600 V for 208Y/120.
 - 3. Neutral to Ground: 1200 V for 480Y/277: 600 V for 208Y/120.
- D. Protection modes and UL 1449 VPR for 240/120-V, single-phase, 3-wire circuits shall be as follows:
 - 1. Line to Neutral: 600 V.
 - 2. Line to Ground: 600 V.
 - 3. Neutral to Ground: 600 V.
- E. Protection modes and UL 1449 VPR for 240/120-V, 3-phase, 4-wire circuits with high leg shall be as follows:
 - 1. Line to Neutral: 600 V, 800 V from high leg.
 - 2. Line to Ground: 600 V.
 - 3. Neutral to Ground: 600 V.
- F. Connection Means: Permanently wired through a 3-P breaker (the size of the breaker shall be as recommended by the SPD manufacturer). The breaker shall be installed in the panelboard and shall be rated with the same electrical characteristics of the panel board.
- G. Short Circuit Withstand Rating: The device shall have a short circuit withstand rating identical to the equipment that it is connected. Rating shall be permanently marked on the device.
- H. SPD for Kitchen panels shall be installed integral to the panel board. No externally mounted surge is acceptable.
- I. Approved manufacturers:
 - 1. LEA International
 - 2. Advanced Protection Technologies
 - 3. Cooper Crouse-Hinds MTL, Inc
 - 4. Liebert
 - 5. PQ Protection
 - 6. Panel board manufacturer.

2.3 ENCLOSURES

- A. NEMA 250, with type matching the enclosure of panel or device being protected.

2.4 COMMUNICATIONS

- A. Entrance SPD shall be type 2 rated 20KA or more nominal discharge current (In) and labeled for lightning protection installations.

B. Communication Lines: The following standard for separately mounted telephone and signal line suppressors shall apply. All protectors shall be securely mounted at protected equipment location. All suppressors shall provide common (L-G) and normal (L-L) protection. Suppressors shall be tested in accordance with IEEE C62.45 2002 as a minimum. Protective interfacing with the telephone wire pairs shall be listed to UL 497A.

C. Data Line Protection: Solid state, silicon avalanche diode circuitry for protection from over voltages on long cable runs employing standard RS-232, 9, 15, or 25-pin "D" connectors utilized to interface a remote station with a host CPU. Unit shall have 2 built-in or ribbon cable attached connectors (in and out) and an external ground lug or cable. Connect ground lug or cable to CPU or terminal grounding system with a No. 12 copper green insulated stranded ground wire as short as possible. Select pins requiring protection based on protected equipment wiring requirements. Protectors shall be designed to be easily installed on multiplex panels with connector spacing at a minimum of 1.0-inch centers.

1. Signal line voltage (max) 15 V peak
2. Leakage at signal voltage <5 mA
3. Voltage protection level 16 V peak
4. Response time 5 nanoseconds or less
5. Impedance per line 40 ohm max.
6. Peak power dissipation 15,000 watts (10/1000 Test Wave form)
7. Temperature range -20° C to +65°C
8. Capacitance:
 - a. Data rates <20,000 baud - <2,000 pf
 - b. Data rates 20,000 baud to 2 MHz - <100 pf
 - c. Data rates >2 MHz to 100 MHz - <40 pf
9. UL 497B listed.
10. Approved Manufacturers: EDCO, Transtector, or Atlantic Scientific

D. Signal line protection (telephone) - solid state, silicon avalanche diode circuitry for protection from over voltages on 2 or 4 wire signal lines such as balanced pair telephone, metallic pair telephone, buried and overhead field cable, remote radio equipment, and control systems. Unit shall have an external ground lug or wire. Connect ground lug or wire to protected equipment grounding system with a No. 12 green insulated stranded ground wire as short as possible.

L-L & L-G Voltage (peak)	L-L & L-G VPL	
13	16	
27	33	
	54	67
120	150	
160	200	
2. L-L and L-G Leakage		
@ max L-L and L-G voltage	<5 µA	
3.	Response time	<5 nanoseconds
3.	Series impedance (each line)	33 Ohm max.
4.	Peak power dissipation (L-L) or (L-G)	15,000 watts (10 x 1000 Test Wave Form)

6. Temperature Range -20°C to +65°C

7. U.L. 497B listed

8. Approved Manufacturers: EDCO, Transtector, or Atlantic Scientific.

E. Modem protector for leased lines - solid-state silicon avalanche diode circuitry for non-faulting/non-interrupting protection from over voltages on leased phone lines. Full duplex protection shall be provided for both send and receive channels. Terminals shall be provided for 4-wire leased line input and output to equipment plus ground. Connect ground terminal to equipment ground.

1. Signal line voltage (max) 160V peak

2. Leakage @ signal voltage 5 µa

3. Clamp point 200V peak

4. Response time <5 nanoseconds.

5. Series impedance 33 Ohm max.

6. Peak power dissipation 15,000 watts

7. Operating Temperature -20°C to +65°C

8. Approved Manufacturers: EDCO, Transtector, or Atlantic Scientific.

F. Modular, twisted pair protection - solid state, silicon avalanche diode circuitry for protection from over voltages on twisted pair data or audio lines. Protectors shall clip mount on 66 punch down blocks furnished with grounding bar or studs and shall be totally enclosed. Units shall be securely mounted at terminal locations where shown and shall be grounded to the main building ground with a minimum No. 8 stranded copper green insulated ground conductor as short as possible. Terminals shall be screw insertion lug type. No crimp fork or ring type permitted.

1. Response time <5 nanoseconds

2. Peak power dissipation (1 ms) 15,000 watts

3. Temperature range -20° C to +50°C

4. Maximum voltage protection levels (peak) utilizing a 10 x 1000 µs waveform for normal and common mode protection shall be 240-380V or 45V as indicated on the drawings.

5. Peak repetitive pulse current

a. 1 x 2 µs - 225 amp

b. 8 x 20 µs - 150 amp

c. 10 x 1000 µs -100 amp

6. Approved Manufacturers: EDCO, Transtector, or Atlantic Scientific.

- G. 75 ohm coaxial cable protectors - Solid state, silicon avalanche diode circuitry for non-interrupting over-voltage protection of RG-59/U coaxial cable. Unit shall be provided with one female input connector for "F" series male connector, one output RG-59/U coax cable terminated with an "F" series male cable end connector and A #16 stranded, 18 inch long grounding wire on output end of unit or similar arrangement. Securely mount adjacent to protection equipment and ground to equipment or local building ground if an equipment ground is not available.

1. Normal Operating Characteristics

- a. Voltage 5.8V max
- b. Current 500 ma max
- c. Frequency DC to 10 MHz
- d. Insertion Loss 3.5 dB @ 4 MHz

2. Protection Requirements

- a. Transient suppression level 7.5 v VPL
- b. Transient response <5 nanoseconds
- c. Operating temp -20°C to +50°C
- d. Energy dissipation 15,000 watts (10X1000 Test Wave)

3. Approved Manufacturers: EDCO, Transtector, or Atlantic Scientific.

PART 3 - EXECUTION

3.1 INSTALLATION OF SURGE PROTECTION DEVICES

- A. Installation at Service and Distribution Panels: Suppressors shall be installed at Service Entrance switchboards or switch-gear as close as practical to distribution equipment to be protected consistent with the available space, however, do not exceed three feet.
- B. Installation at Lighting and Appliance Panelboards: The SPD shall be installed as close as practical to the electrical panel or electronic equipment to be protected, consistent with available space. Pre-wired leads shall be field cut to minimize the length between panel connection point. SPD leads shall be routed as straight as possible and as short as possible to the panelboard breaker. In no case shall leads exceed 18" length.
- C. Workmanship: SPDs shall be installed in a neat, workmanlike manner. Lead dress shall be consistent with recommended industry practices for the system on which these devices are installed.

- D. 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.
- E. Disconnect SPD via circuit breaker connection prior to megger testing of service entrance.
- F. Install devices at service entrance on load side, with ground lead bonded to service entrance ground.
- G. Install devices for panel board and auxiliary panels with conductors or buses between suppressor and points of attachment as short and straight as possible, but in no case shall the leads be more than 24 inches. Do not exceed manufacturer's recommended lead length, but in no case shall the leads be more than 24 inches. Do not bond neutral and ground.
 - 1. Provide multipole, 30A (for panelboards) 60A (for service entrance equipment) circuit breaker as a dedicated disconnect for suppressor whether shown on drawings or not. Size shall be as required by the SPD manufacturers installation instructions.

3.2 PLACING SYSTEM INTO SERVICE

- A. Do not energize or connect service entrance equipment, panelboards, control terminals, or data terminals to their sources until surge protection devices are installed and connected.

3.3 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect equipment installation, including connections.
 - 1. Verify that electrical wiring installation complies with manufacturer's written installation requirements.
 - 2. Perform each visual and mechanical inspection stated in NETA ATS, "Surge Arresters, Low-Voltage Surge Protection Devices" Section.
- B. Remove and replace malfunctioning units and retest as specified above.

END OF SECTION 26 43 13

SECTION 265100 - 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. This Section includes the following:
 - 1. Interior lighting fixtures, lamps, and ballasts.
 - 2. Emergency lighting units.
 - 3. Exit signs.
 - 4. Lighting fixture supports.
- B. Related Sections include the following:
 - 1. Division 26 Section "Stand Alone Lighting Control Devices" for automatic control of lighting, including time switches, photoelectric relays, occupancy sensors, and multipole lighting relays and contactors.
 - 2. Division 26 Section "Wiring Devices" for manual wall-box dimmers for incandescent lamps.

1.3 DEFINITIONS

- A. BF: Ballast factor.
- B. CRI: Color-rendering index.
- C. CU: Coefficient of utilization.
- D. HID: High-intensity discharge.
- E. LER: Luminaire efficacy rating.
- F. Luminaire: Complete lighting fixture, including ballast housing if provided.
- G. RCR: Room cavity ratio.

1.4 SUBMITTALS

- A. Product Data: For each type of lighting fixture, arranged in order of fixture designation. Include data on features, accessories, finishes, and the following:
 - 1. Physical description of lighting fixture including dimensions.
 - 2. Emergency lighting units including battery and charger.
 - 3. Ballast.

4. Energy-efficiency data.
 5. Life, output, and energy-efficiency data for lamps.
 6. Photometric data, in IESNA format, based on laboratory tests of each lighting fixture type, outfitted with lamps, ballasts, and accessories identical to those indicated for the lighting fixture as applied in this Project.
- B. Shop Drawings: Show details of nonstandard or custom lighting fixtures. Indicate dimensions, weights, methods of field assembly, components, features, and accessories.
1. Wiring Diagrams: Power and control wiring.
 2. Detail wiring for fixtures and differentiate between manufacturer-installed and field-installed wiring.
- C. Coordination Drawings: Reflected ceiling plan(s) and other details, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:
1. Lighting fixtures.
 2. Suspended ceiling components.
 3. Structural members to which suspension systems for lighting fixtures will be attached.
 4. Other items in finished ceiling including the following:
 - a. Air outlets and inlets.
 - b. Speakers.
 - c. Sprinklers.
 - d. Smoke and fire detectors.
 - e. Occupancy sensors.
 - f. Access panels.
 - g. Projectors
 - h. IR Sensors
 - i. Wireless Access Points
- D. Samples for Verification: Interior lighting fixtures designated for sample submission in Interior Lighting Fixture Schedule. Each sample shall include the following:
1. Lamps: Specified units installed.
 2. Accessories: Cords and plugs.
- E. Product Certificates: For each type of ballast for bi-level and dimmer-controlled fixtures, signed by product manufacturer.
- F. Operation and Maintenance Data: For lighting equipment and fixtures to include in operation, and maintenance manuals.
- G. Warranties: Special warranties specified in this Section.

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. FMG Compliance: Lighting fixtures for hazardous locations shall be listed and labeled for indicated class and division of hazard by FMG.
- D. NFPA 101 Compliance: Comply with visibility and luminance requirements for exit signs and emergency lighting.
- E. Mockups: Provide interior lighting fixtures for room or module mockups, complete with power and control connections.
 - 1. Obtain Architect's approval of fixtures for mockups before starting installations.
 - 2. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
 - 3. Approved fixtures in mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 COORDINATION

- A. Coordinate layout and installation of lighting fixtures and suspension system with other construction that penetrates ceilings or is supported by them, including HVAC equipment, fire-suppression system, and partition assemblies.

1.7 ADDITIONAL DEVICES FOR JURSDICTION COMPLIANCE

- A. Provide in the GMP bid for ten additional exit signs as directed in field. Allowance includes purchase, delivery and installation of box, exit sign, wire and 50 feet of conduit for each sign.
- B. Provide in the GMP bid for fifteen additional emergency battery units as directed in field. Allowance includes purchase, delivery and installation of box, battery unit, wire and 50 feet of conduit for each emergency battery unit.

1.8 WARRANTY

- A. Special Warranty for Emergency Lighting Batteries: Manufacturer's standard form in which manufacturer of battery-powered emergency lighting unit agrees to repair or replace components of rechargeable batteries that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period for Emergency Lighting Unit Batteries: 10 years from date of Substantial Completion. Full warranty shall apply for first year, and prorated warranty for the remaining nine years.
 - 2. Warranty Period for Emergency Fluorescent Ballast and Self-Powered Exit Sign Batteries: Five years from date of Substantial Completion. Full warranty shall apply for first year, and prorated warranty for the remaining four years.
- B. Special Warranty for Ballasts: Manufacturer's standard form in which ballast manufacturer agrees to repair or replace ballasts that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period for Electronic Ballasts: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Lighting Fixture Products: Subject to compliance with requirements, products that may be incorporated into the Work include the products indicated in the Lighting Fixture Schedule.
- B. Lamps: Subject to compliance with requirements, products that may be incorporated into the Work include:
 - 1. Osram Sylvania
 - 2. General Electric
 - 3. Philips
- C. Ballast: Subject to compliance with requirements, products that may be incorporated into the Work include:
 - 1. Universal Lighting Technology
 - 2. Advance
 - 3. Osram Sylvania

2.2 LIGHTING FIXTURES AND COMPONENTS, GENERAL REQUIREMENTS

- A. Recessed Fixtures: Comply with NEMA LE 4 for ceiling compatibility for recessed fixtures.
- B. Incandescent Fixtures: Comply with UL 1598. Where LER is specified, test according to NEMA LE 5A.
- C. Fluorescent Fixtures: Comply with UL 1598. Where LER is specified, test according to NEMA LE 5 and NEMA LE 5A as applicable.
- D. HID Fixtures: Comply with UL 1598. Where LER is specified, test according to NEMA LE 5B.
- E. Metal Parts: Free of burrs and sharp corners and edges.
- F. Sheet Metal Components: Steel, unless otherwise indicated. Form and support to prevent warping and sagging.
- G. 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.
- H. 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.

- I. 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 0.125 inch (3.175 mm) minimum unless different thickness is indicated.
 - b. UV stabilized.
 - 2. Glass: Annealed crystal glass, unless otherwise indicated.
- J. Electromagnetic-Interference Filters: Factory installed to suppress conducted electromagnetic-interference as required by MIL-STD-461E. Fabricate lighting fixtures with one filter on each ballast indicated to require a filter.

2.3 BALLASTS FOR LINEAR FLUORESCENT LAMPS

- A. Electronic Ballasts: Comply with ANSI C82.11; instant-start type, unless otherwise indicated, and designed for type and quantity of lamps served. Ballasts shall be designed for full light output unless dimmer or bi-level control is indicated.
 - 1. Sound Rating: A.
 - 2. Total Harmonic Distortion Rating: Less than 20 percent.
 - 3. Transient Voltage Protection: IEEE C62.41, Category A or better.
 - 4. Operating Frequency: 20 kHz or higher.
 - 5. Lamp Current Crest Factor: 1.6 or less.
 - 6. BF: 0.85 or higher.
 - 7. Power Factor: 0.95 or higher.
 - 8. Parallel Lamp Circuits: Multiple lamp ballasts shall comply with ANSI C 82.11 and shall be connected to maintain full light output on surviving lamps if one or more lamps fail.
- B. Electronic Programmed-Start Ballasts for T5 and T5HO Lamps: Comply with ANSI C82.11 and the following:
 - 1. Lamp end-of-life detection and shutdown circuit for T5 diameter lamps.
 - 2. Automatic lamp starting after lamp replacement.
 - 3. Sound Rating: A.
 - 4. Total Harmonic Distortion Rating: Less than 20 percent.
 - 5. Transient Voltage Protection: IEEE C62.41, Category A or better.
 - 6. Operating Frequency: 20 kHz or higher.
 - 7. Lamp Current Crest Factor: 1.7 or less.
 - 8. BF: 0.95 or higher, unless otherwise indicated.
 - 9. Power Factor: 0.95 or higher.
- C. Electromagnetic Ballasts: Comply with ANSI C82.1; energy saving, high-power factor, Class P, and having automatic-reset thermal protection.
 - 1. Ballast Manufacturer Certification: Indicated by label.
- D. Single Ballasts for Multiple Lighting Fixtures: Factory-wired with ballast arrangements and bundled extension wiring to suit final installation conditions without modification or rewiring in the field.
- E. Ballasts to be in 1, 2, 3 or 4 lamp configuration as required to facilitate switching/circuitry shown on drawings or as called for on drawings. If not specifically called for or noted on

drawings provide minimum of one ballast per two lamp fixture, two ballasts per 3 lamp or 4 lamp fixture.

- F. Ballasts for Low-Temperature Environments:
 - 1. Temperatures 0 Deg F (Minus 17 Deg C) and Higher: Electronic type rated for 0 deg F (minus 17 deg C) starting and operating temperature with indicated lamp types.
 - 2. Temperatures Minus 20 Deg F (Minus 29 Deg C) and Higher: Electromagnetic type designed for use with indicated lamp types.
- G. Ballasts for Low Electromagnetic-Interference Environments: Comply with 47 CFR, Chapter 1, Part 18, Subpart C, for limitations on electromagnetic and radio-frequency interference for consumer equipment.
- H. Ballasts for Dimmer-Controlled Lighting Fixtures: Electronic type.
 - 1. Dimming Range: 100 to 5 percent of rated lamp lumens.
 - 2. Ballast Input Watts: Can be reduced to 20 percent of normal.
 - 3. Compatibility: Certified by manufacturer for use with specific dimming control system and lamp type indicated.
- I. Ballasts for Bi-Level Controlled Lighting Fixtures: Electronic type.
 - 1. Operating Modes: Ballast circuit and leads provide for remote control of the light output of the associated lamp between high- and low-level and off.
 - a. High-Level Operation: 100 percent of rated lamp lumens.
 - b. Low-Level Operation: 50 percent of rated lamp lumens.
 - 2. Ballast shall provide equal current to each lamp in each operating mode.
 - 3. Compatibility: Certified by manufacturer for use with specific bi-level control system and lamp type indicated.

2.4 BALLASTS FOR COMPACT FLUORESCENT LAMPS

- A. Description: Electronic programmed rapid-start type, complying with ANSI C 82.11, designed for type and quantity of lamps indicated. Ballast shall be designed for full light output unless dimmer or bi-level control is indicated:
 - 1. Lamp end-of-life detection and shutdown circuit.
 - 2. Automatic lamp starting after lamp replacement.
 - 3. Sound Rating: A.
 - 4. Total Harmonic Distortion Rating: Less than 20 percent.
 - 5. Transient Voltage Protection: IEEE C62.41, Category A or better.
 - 6. Operating Frequency: 20 kHz or higher.
 - 7. Lamp Current Crest Factor: 1.7 or less.
 - 8. BF: 0.95 or higher, unless otherwise indicated.
 - 9. Power Factor: 0.95 or higher.
 - 10. Interference: Comply with 47 CFR, Chapter 1, Part 18, Subpart C, for limitations on electromagnetic and radio-frequency interference for nonconsumer equipment.
 - 11. Ballast Case Temperature: 75 deg C, maximum.
- B. Ballasts for Dimmer-Controlled Lighting Fixtures: Electronic type.
 - 1. Dimming Range: 100 to 5 percent of rated lamp lumens.
 - 2. Ballast Input Watts: Can be reduced to 20 percent of normal.

3. Compatibility: Certified by manufacturer for use with specific dimming control system and lamp type indicated.

2.5 EMERGENCY FLUORESCENT POWER UNIT

- A. Internal Type: Self-contained, modular, battery-inverter unit, factory mounted within lighting fixture body and compatible with ballast. Comply with UL 924.
 1. Emergency Connection: Operate fluorescent lamp(s) continuously at an output of 1100 lumens each. Connect unswitched circuit to battery-inverter unit and switched circuit to fixture ballast.
 2. Test Push Button and Indicator Light: Visible and accessible without opening fixture or entering ceiling space.
 - a. Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
 - b. Indicator Light: LED indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
 3. Battery: Sealed, maintenance-free, nickel-cadmium type.
 4. Charger: Fully automatic, solid-state, constant-current type with sealed power transfer relay.
 5. Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by a flashing red LED. No audible alarm is permitted.

2.6 BALLASTS FOR HID LAMPS

- A. Electromagnetic Ballast for Metal-Halide Lamps: Comply with ANSI C82.4 and UL 1029. Include the following features, unless otherwise indicated:
 1. Ballast Circuit: Constant-wattage autotransformer or regulating high-power-factor type.
 2. Minimum Starting Temperature: Minus 22 deg F (Minus 30 deg C) for single-lamp ballasts.
 3. Normal Ambient Operating Temperature: 104 deg F (40 deg C).
 4. Open-circuit operation that will not reduce average life.
 5. Low-Noise Ballasts: Manufacturers' standard epoxy-encapsulated models designed to minimize audible fixture noise.
- B. Electronic Ballast for Metal-Halide Lamps: Include the following features unless otherwise indicated:
 1. Lamp end-of-life detection and shutdown circuit.
 2. Sound Rating: A.
 3. Total Harmonic Distortion Rating: Less than 15 percent.
 4. Transient Voltage Protection: IEEE C62.41, Category A or better.
 5. Lamp Current Crest Factor: 1.5 or less.
 6. Power Factor: .90 or higher.
 7. Interference: Comply with 47 CFR, Chapter 1, Part 18, Subpart C, for limitations on electromagnetic and radio-frequency interference for nonconsumer equipment.
 8. Protection: Class P thermal cutout.
 9. Bi-Level Dimming Ballast: Ballast circuit and leads provide for remote control of the light output of the associated fixture between high- and low-level and off.
 - a. High-Level Operation: 100 percent of rated lamp lumens.

- b. Low-Level Operation: 50 percent of rated lamp lumens.
 - c. Compatibility: Certified by ballast manufacturer for use with specific bi-level control system and lamp type indicated. Certified by lamp manufacturer that ballast operating modes are free from negative effect on lamp life and color-rendering capability.
10. Continuous Dimming Ballast: Dimming range shall be from 100 to 35 percent of rated lamp lumens without flicker.
- a. Ballast Input Watts: Reduced to a maximum of 50 percent of normal at lowest dimming setting.
 - b. Compatibility: Certified by manufacturer for use with specific dimming control system and lamp type indicated. Certified by lamp manufacturer that ballast operating modes are free from negative effect on lamp life and color-rendering capability.
- C. Auxiliary Instant-On Quartz System: Factory-installed feature automatically switches quartz lamp on when fixture is initially energized and when power outages occur. System automatically turns quartz lamp off when HID lamp reaches approximately 60 percent light output.
- D. High-Pressure Sodium Ballasts: Electromagnetic type, with solid-state igniter/starter. Igniter-starter shall have an average life in pulsing mode of 10,000 hours at an igniter/starter-case temperature of 90 deg C.
- 1. Instant-Restrike Device: Integral with ballast, or solid-state potted module, factory installed within fixture and compatible with lamps, ballasts, and mogul sockets up to 150 W.
 - a. Restrike Range: 105- to 130-V ac.
 - b. Maximum Voltage: 250-V peak or 150-V ac RMS.
 - 2. Minimum Starting Temperature: Minus 40 deg F (Minus 40 deg C).
 - 3. Open-circuit operation shall not reduce average lamp life.

2.7 EXIT SIGNS

- A. Description: Comply with UL 924; for sign colors, visibility, luminance, and lettering size, comply with authorities having jurisdiction.
- B. Internally Lighted Signs:
- 1. Lamps for AC Operation: Fluorescent, 2 for each fixture, 20,000 hours of rated lamp life.
 - 2. Lamps for AC Operation: LEDs, 70,000 hours minimum rated lamp life.
 - 3. Self-Powered Exit Signs (Battery Type): Integral automatic charger in a self-contained power pack.
 - a. Battery: Sealed, maintenance-free, nickel-cadmium type.
 - b. Charger: Fully automatic, solid-state type with sealed transfer relay.
 - c. Operation: Relay automatically energizes lamp from battery when circuit voltage drops to 80 percent of nominal voltage or below. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
 - d. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.

- e. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
- f. Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is announced by an integral audible alarm and flashing red LED.

2.8 EMERGENCY LIGHTING UNITS

- A. Description: Self-contained units complying with UL 924.
 - 1. Battery: Sealed, maintenance-free, lead-acid type.
 - 2. Charger: Fully automatic, solid-state type with sealed transfer relay.
 - 3. Operation: Relay automatically turns lamp on when power supply circuit voltage drops to 80 percent of nominal voltage or below. Lamp automatically disconnects from battery when voltage approaches deep-discharge level. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
 - 4. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
 - 5. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
 - 6. Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is announced by an integral audible alarm and flashing red LED.

2.9 FLUORESCENT LAMPS

- A. Low-Mercury Lamps: Comply with EPA's toxicity characteristic leaching procedure test; shall yield less than 0.2 mg of mercury per liter when tested according to NEMA LL 1.
- B. T8 rapid-start lamps, rated 32 W maximum, nominal length of 48 inches (1220 mm), 2800 initial lumens (minimum), CRI 80, color temperature 4100 K, and average rated life 20,000 hours, unless otherwise indicated.
- C. T8 rapid-start lamps, rated 17 W maximum, nominal length of 24 inches (610 mm), 1300 initial lumens (minimum), CRI 75 (minimum), color temperature 4100 K, and average rated life of 20,000 hours, unless otherwise indicated.
- D. T5 rapid-start lamps, rated 28 W maximum, nominal length of 45.2 inches (1150 mm), 2900 initial lumens (minimum), CRI 85 (minimum), color temperature 4100 K, and average rated life of 20,000 hours, unless otherwise indicated.
- E. T5HO rapid-start, high-output lamps, rated 54 W maximum, nominal length of 45.2 inches (1150 mm), 5000 initial lumens (minimum), CRI 85 (minimum), color temperature 4100 K, and average rated life of 20,000 hours, unless otherwise indicated.
- F. Compact Fluorescent Lamps: 4-Pin, CRI 80 (minimum), color temperature 4100 K, average rated life of 10,000 hours at 3 hours operation per start, and suitable for use with dimming ballasts, unless otherwise indicated.
 - 1. 13 W: T4, double or triple tube, rated 900 initial lumens (minimum).

2. 18 W: T4, double or triple tube, rated 1200 initial lumens (minimum).
3. 26 W: T4, double or triple tube, rated 1800 initial lumens (minimum).
4. 32 W: T4, triple tube, rated 2400 initial lumens (minimum).
5. 42 W: T4, triple tube, rated 3200 initial lumens (minimum).
6. 55 W: T4, triple tube, rated 4300 initial lumens (minimum).

2.10 HID LAMPS

- A. High-Pressure Sodium Lamps: ANSI C78.42, CRI 21 (minimum), color temperature 1900 K, and average rated life of 24,000 hours, minimum.
 1. Dual-Arc Tube Lamps: Arranged so only one of two arc tubes is lighted at one time and, when power is restored after an outage, the cooler arc tube, with lower internal pressure, lights instantly, providing an immediate 8 to 15 percent of normal light output.
- B. Metal-Halide Lamps: ANSI C78.1372, with a minimum CRI 65, and color temperature 4000 K.

2.11 LIGHTING FIXTURE SUPPORT COMPONENTS

- A. Comply with Division 26 Section "Hangers and Supports for Electrical Systems" for channel- and angle-iron supports and nonmetallic channel and angle supports.
- B. Single-Stem Hangers: 1/2-inch (13-mm) steel tubing with swivel ball fittings and ceiling canopy. Finish same as fixture.
- 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: Stainless Steel aircraft cable 1/16" minimum.
- E. Rod Hangers: 3/16-inch (5-mm) minimum diameter, cadmium-plated, threaded steel rod.
- F. Hook Hangers: Integrated assembly matched to fixture and line voltage and equipped with threaded attachment, cord, and locking-type plug.

2.12 SAFETY REQUIREMENTS FOR INDIVIDUAL LIGHTING FIXTURES

- A. Fixtures located overhead shall have at least 1 redundant point of support. That is if one support fails the fixture shall not be capable of falling to the ground. Provide aircraft cable with nico press crimps for redundant support of fixtures with only 1 point of connection.
- B. Fluorescent fixtures with lamps exposed shall have wire guards and clear tube guards to prevent the lamps or glass from falling.
- C. All exit and emergency fixtures located in Gymnasium or locker room areas shall be equipped with a wire cage to prevent damage.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Lighting fixtures: Set level, plumb, and square with ceilings and walls. Install lamps in each fixture.
- B. Support for Lighting Fixtures in or on Grid-Type Suspended Ceilings: Use grid as a support element.
 - 1. Install a minimum of two ceiling support system rods or wires for each fixture. Locate not more than 6 inches (150 mm) from lighting fixture corners.
 - 2. Fixtures of Sizes Less Than Ceiling Grid: Install as indicated on reflected ceiling plans or center in acoustical panel, and support fixtures independently with at least two 3/4-inch (20-mm) metal channels spanning and secured to ceiling tees.
 - 3. Fixtures supported by suspended ceiling systems shall be securely fastened to the ceiling framing member by mechanical means, such as bolts, screws, or rivets. Ceiling framing members must be securely attached to each other and to the building structure as required by all applicable codes and standards. Use of integral clips is not permitted.
- C. Suspended Lighting Fixture Support:
 - 1. Pendants and Rods: Where longer than 48 inches (1200 mm), brace to limit swinging.
 - 2. Stem-Mounted, Single-Unit Fixtures: Suspend with twin-stem hangers.
 - 3. Continuous Rows: Use tubing or stem for wiring at one point and tubing or rod for suspension for each unit length of fixture chassis, including one at each end.
 - 4. Provide redundant support for all suspended lighting fixtures.
 - 5. Provide threaded swivel support for fixtures mounted on sloped ceilings.
- D. Adjust aimable lighting fixtures to provide required light intensities.
- E. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."
- F. Install wire guards and clear tube guards on all exposed lamp fluorescent fixtures.

3.2 CONNECTIONS

- A. Ground equipment.
 - 1. 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. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery and retransfer to normal.
- B. Inspect each installed fixture for damage. Replace damaged fixtures and components.
- C. Advance Notice: Give dates and times for field tests.

- D. Provide instruments to make and record test results.
- E. Tests: As follows:
 - 1. Verify normal operation of each fixture after installation.
 - 2. Emergency Lighting: Interrupt electrical supply to demonstrate proper operation.
 - 3. Verify normal transfer to battery source and retransfer to normal.
 - 4. Report results in writing.
- F. Malfunctioning Fixtures and Components: Replace or repair, then retest. Repeat procedure until units operate properly.
- G. Corrosive Fixtures: Replace during warranty

3.4 CLEANING

- A. Clean fixtures internally and externally after installation. Use methods and materials recommended by manufacturer.

3.5 TRAINING

- A. Instruct Owner on testing and maintenance responsibilities required by NFPA 101 related to normal egress lighting, emergency battery units and exit fixtures.

END OF SECTION 265100

SECTION 265619 - EXTERIOR 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. Exterior solid-state luminaires that are designed for and exclusively use LED lamp technology.
 - 2. Luminaire supports.
 - 3. Luminaire-mounted photoelectric relays.

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. Lumen: Measured output of lamp and luminaire, or both.
- F. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of luminaire.
 - 1. Arrange in order of luminaire designation.
 - 2. Include data on features, accessories, and finishes.
 - 3. Include physical description and dimensions of luminaire.
 - 4. Lamps, include life, output (lumens, CCT, and CRI), and energy-efficiency data.
 - 5. Photometric data and adjustment factors based on laboratory tests, complying with IES.
 - a. Manufacturer's Certified Data: Photometric data certified by manufacturer's laboratory with a current accreditation under the NVLAP 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.
 6. Wiring diagrams for power, control, and signal wiring.
 7. Photoelectric relays.
 8. Means of attaching luminaires to supports and indication that the attachment is suitable for components involved.
- B. Shop Drawings: For nonstandard or custom luminaires.
1. Include plans, elevations, sections, and mounting and attachment details.
 2. Include details of luminaire assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 3. Include diagrams for power, signal, and control wiring.
 4. Product Data for Credit EA 5: For specified metering equipment.
 5. Product Data for Credit MR 4: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating cost for each product having recycled content.
- C. Samples: For each luminaire and for each color and texture indicated with factory-applied finish.
- D. Product Schedule: For luminaires and lamps.
- E. Delegated-Design Submittal: For luminaire supports.
1. Include design calculations for luminaire supports.

1.5 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
1. Luminaires.
 2. Structural members to which luminaires will be attached.
- B. Qualification Data: For testing laboratory providing photometric data for luminaires.
- C. Seismic Qualification Certificates: For luminaires, accessories, and components, from manufacturer.
1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

- D. Product Certificates: For each type of the following:
 - 1. Luminaire.
 - 2. Photoelectric relay.
- E. Product Test Reports: For each luminaire, for tests performed by qualified testing agency.
- F. Source quality-control reports.
- G. Sample warranty.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For luminaires to include in operation and maintenance manuals.
 - 1. Provide a list of all lamp types used on Project. Use ANSI and manufacturers' codes.
 - 2. Provide a list of all photoelectric relay types used on Project; use manufacturers' codes.

1.7 QUALITY ASSURANCE

- A. Luminaire Photometric Data Testing Laboratory Qualifications: Luminaire manufacturers' laboratory that is accredited under the NVLAP for Energy Efficient Lighting Products.
- B. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by an independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910.7, accredited under the NVLAP for Energy Efficient Lighting Products and complying with applicable IES testing standards.
- C. Provide luminaires from a single manufacturer for each luminaire type.
- D. Each luminaire type shall be binned within a three-step MacAdam Ellipse to ensure color consistency among luminaires.
- E. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.
- F. Mockups: For exterior luminaires, complete with power and control connections.
 - 1. Obtain Architect's approval of luminaires in mockups before starting installations.
 - 2. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed work.
 - 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.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Protect finishes of exposed surfaces by applying a strippable, temporary protective covering prior to shipping.

1.9 FIELD CONDITIONS

- A. Verify existing and proposed utility structures prior to the start of work associated with luminaire installation.
- B. Mark locations of exterior luminaires for approval by Architect prior to the start of luminaire installation.

1.10 WARRANTY

- A. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures, including luminaire support components.
 - b. Faulty operation of luminaires and accessories.
 - c. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
 - 2. Warranty Period: 5 year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Luminaires and lamps shall be labeled vibration and shock resistant.
 - 1. The term "withstand" means "the luminaire will remain in place without separation of any parts when subjected to the seismic forces."

2.2 LUMINAIRE REQUIREMENTS

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. NRTL Compliance: Luminaires 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. UL Compliance: Comply with UL 1598 and wet locations.
- E. Lamp base complying with ANSI and IES.
- F. Bulb shape complying with ANSI C79.1.
- G. CRI of 80. CCT of 41000K.
- H. L70 lamp life of 50,000 hours.
- I. Lamps dimmable from 100 percent to 0 percent of maximum light output.
- J. Internal driver.
- K. In-line Fusing: On the primary for each luminaire.
- L. Lamp Rating: Lamp marked for outdoor use.
- M. Source Limitations: Obtain luminaires from single source from a single manufacturer.
- N. Source Limitations: For luminaires, obtain each color, grade, finish, type, and variety of luminaire from single source with resources to provide products of consistent quality in appearance and physical properties.

2.3 MATERIALS

- A. Metal Parts: Free of burrs and sharp corners and edges.
- B. Sheet Metal Components: Corrosion-resistant aluminum. 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. Doors shall be removable for cleaning or replacing lenses.
- D. Diffusers and Globes:
 - 1. Acrylic Diffusers: 100 percent virgin acrylic plastic, with high resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
 - 2. Glass: Annealed crystal glass unless otherwise indicated.
 - 3. Lens Thickness: At least 0.125 inch ((3.175 mm)) minimum unless otherwise indicated.
- E. Lens and Refractor Gaskets: Use heat- and aging-resistant resilient gaskets to seal and cushion lenses and refractors in luminaire doors.
- F. 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.

G. Housings:

1. Rigidly formed, weather- and light-tight enclosure that will not warp, sag, or deform in use.
2. Provide filter/breather for enclosed luminaires.

H. Factory-Applied Labels: Comply with UL 1598. Include recommended lamps. Labels shall be located where they will be readily visible to service personnel, but not seen from normal viewing angles when lamps are in place.

1. Label shall include the following lamp characteristics:
 - a. "USE ONLY" and include specific lamp type.
 - b. Lamp diameter, shape, size, wattage and coating.
 - c. CCT and CRI for all luminaires.

2.4 FINISHES

A. Variations in Finishes: Noticeable variations in same piece are unacceptable. 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.

B. Luminaire Finish: Manufacturer's standard paint applied to factory-assembled and -tested luminaire before shipping. Where indicated, match finish process and color of pole or support materials.

C. Factory-Applied Finish for Aluminum Luminaires: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

1. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
2. Natural Satin Finish: Provide fine, directional, medium satin polish (AA-M32); buff complying with AA-M20 requirements; and seal aluminum surfaces with clear, hard-coat wax.
3. Class I, Clear-Anodic Finish: AA-M32C22A41 (Mechanical Finish: Medium satin; Chemical Finish: Etched, medium matte; Anodic Coating: Architectural Class I, clear coating 0.018 mm or thicker) complying with AAMA 611.
4. Class I, Color-Anodic Finish: AA-M32C22A42/A44 (Mechanical Finish: Medium satin; Chemical Finish: Etched, medium matte; Anodic Coating: Architectural Class I, integrally colored or electrolytically deposited color coating 0.018 mm or thicker), complying with AAMA 611.

D. Factory-Applied Finish for Steel Luminaires: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

1. Surface Preparation: Clean surfaces to comply with SSPC-SP 1, to remove dirt, oil, grease, and other contaminants that could impair paint bond. Grind welds and polish surfaces to a smooth, even finish. Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 5/NACE No. 1 or SSPC-SP 8.
2. Exterior Surfaces: Manufacturer's standard finish consisting of one or more coats of primer and two finish coats of high-gloss, high-build polyurethane enamel.
 - a. Color: As selected from manufacturer's standard catalog of colors.

2.5 LUMINAIRE SUPPORT COMPONENTS

- A. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for channel and angle iron supports and nonmetallic channel and angle supports.

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 luminaire electrical conduit to verify actual locations of conduit connections before luminaire installation.
- C. Examine walls, roofs, and canopy ceilings and overhang ceilings for suitable conditions where luminaires will be installed.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 GENERAL INSTALLATION REQUIREMENTS

- A. Comply with NECA 1.
- B. Use fastening methods and materials selected to resist seismic forces defined for the application and approved by manufacturer.
- C. Install lamps in each luminaire.
- D. Fasten luminaire to structural support.
- E. Supports:
 1. Sized and rated for luminaire weight.
 2. Able to maintain luminaire position after cleaning and relamping.
 3. Support luminaires without causing deflection of finished surface.
 4. Luminaire-mounting devices shall be capable of supporting a horizontal force of 100 percent of luminaire weight and a vertical force of 400 percent of luminaire weight.

- F. Wall-Mounted Luminaire Support:
 - 1. Attached to structural members in walls. Attached to a minimum 1/8 inch (3 mm) backing plate attached to wall structural members. Attached using through bolts and backing plates on either side of wall
- G. Wiring Method: Install cables in raceways. Conceal raceways and cables.
- H. Install luminaires level, plumb, and square with finished grade unless otherwise indicated. Install luminaires at height and aiming angle as indicated on Drawings.
- I. Coordinate layout and installation of luminaires with other construction.
- J. Adjust luminaires that require field adjustment or aiming.
- K. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables" and 260533 "Raceways and Boxes for Electrical Systems" for wiring connections and wiring methods.

3.3 CORROSION PREVENTION

- A. Aluminum: Do not use in contact with earth or concrete. When in direct contact with a dissimilar metal, protect aluminum by insulating fittings or treatment.
- B. Steel Conduits: Comply with Section 260533 "Raceways and Boxes for Electrical Systems." In concrete foundations, wrap conduit with 0.010-inch- (0.254-mm-) thick, pipe-wrapping plastic tape applied with a 50 percent overlap.

3.4 IDENTIFICATION

- A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.5 FIELD QUALITY CONTROL

- A. Inspect each installed luminaire for damage. Replace damaged luminaires and components.
- B. Perform the following tests and inspections.
 - 1. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.
 - 2. Verify operation of photoelectric controls.
- C. Illumination Tests:
 - 1. Measure light intensities at night. Use photometers with calibration referenced to NIST standards.

2. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.
- D. Luminaire will be considered defective if it does not pass tests and inspections.
 - E. 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.

END OF SECTION 265619

SECTION 28 31 11 - ADDRESSABLE 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 01 Specification Sections, apply to this Section.

1.2 DEFINITIONS

- A. LED: Light-emitting diode.
- B. NICET: National Institute for Certification in Engineering Technologies.
- C. Definitions in NFPA 72 apply to fire alarm terms used in this Section.

1.3 STANDARDS, CODES, REFERENCES, AND REGULATORY REQUIREMENTS

- A. Equipment and installation shall comply with the current or applicable provisions of the following standards:
 - 1. ANSI S3.41 American National Standard Audible Emergency Evacuation Signal
 - 2. NFPA 70 National Electric Code (including but not limited to Article 760, Fire Alarm Systems, Article 770 and Article 800)
 - 3. NFPA 72 National Fire Alarm Code
 - 4. NFPA 101 Code For Safety to Life from Fire in Buildings and Structures
 - 5. NFPA 90A Installation of Air Conditioning and Ventilating Systems
 - 6. NFPA 96 Ventilation Control and Fire Protection of Commercial Cooking Operations
 - 7. Underwriters Laboratories Inc. System and all components shall be listed by Underwriters Laboratories Inc. for use in fire protective signaling system under the following standards as applicable:
 - 8. UL 864 (Category UOJZ) APOU Control Units for Fire Protective Signaling Systems. All Control Equipment shall be listed under UL category UOJZ.
 - 9. UL 268 Smoke Detectors for Fire Protective Signaling Systems
 - 10. UL 268A Smoke Detectors for Duct Applications
 - 11. UL 217 Smoke Detectors Single Station
 - 12. UL 521 Heat Detectors for Fire Protective Signaling Systems
 - 13. UL 228 Door Holders for Fire Protective Signaling Systems
 - 14. UL 464 Audible Signaling Appliances
 - 15. UL 1638 Visual Signaling Appliances
 - 16. UL 1481 Power Supplies for Fire Protective Signaling Systems
 - 17. UL 1480 Speakers
 - 18. UL 1424 Cables
 - 19. UL 1971 Signaling Devices for the Hearing Impaired
 - 20. U.L. 1449 - Standard for Safety, Transient Voltage Surge Suppressors.
 - 21. U.L. 497, U.L. 497A, U.L. 497B.
 - 22. IEEE: Fire alarm system includes solid state electronic components. Therefore, the equipment manufacturer shall provide certification that all such equipment is internally protected from, or can withstand, power line surge voltages and currents as specified in

Table 1, Location Category A High Exposure of ANSI/IEEE Standard C62.41-2002 (formerly IEEE Standard 587).

- B. Equipment and installation shall comply with the current or applicable provisions of the following codes and laws:
 - 1. Americans with Disabilities Act (ADA): The fire alarm system shall comply with ADA, Public Law 101-336, 1990. The system shall comply with ADA Accessibility Guidelines (ADAAG).
 - 2. Federal Register - Rules and Regulations - Non-discrimination on the basis of Disability by Public Accommodations and in Commercial Facilities.
 - 3. ASME/ANSI A17.1 – 2004 with 2005 amendments - Elevator Code.
 - 4. Local and State Building Codes.
 - 5. Florida Building Code: Latest adopted edition.
 - 6. Florida Administrative Code. All applicable chapters including but not limited to:
 - 7. Florida Administrative Code 6A-2/SREF (Schools)
 - 8. Florida Administrative Code 10A-12 (Florida Handicap Code - Hospice)

- C. Florida Fire Prevention Code

1.4 SUMMARY

- A. Section Includes:
 - 1. Fire-alarm control unit.
 - 2. Manual fire-alarm boxes.
 - 3. System smoke detectors.
 - 4. Heat detectors.
 - 5. Notification appliances.
 - 6. Magnetic door holders.
 - 7. Remote annunciator.
 - 8. Addressable interface device.

- B. The intent of the contract documents is to maintain the existing Fire alarm and Detection system throughout construction. This will include a tie of the old system to the new system. Drawings have been provided to assist with coordinating this effort, but do not necessarily represent the entire scope of the work. Phasing may be modified and altered by contractor with the Owners approval and all such sequencing may require additional temporary connection, conduit, wiring and equipment. The contractor shall include in the bid all cost to maintain the existing and new system functioning harmoniously.

- C. The work described herein and on the drawings consists of all labor, materials, equipment, and services necessary and required to provide and test automatic fire detection and alarm system. Any material not specifically mentioned in this specification or not shown on the drawings but required for proper performance and operation shall be provided.

- D. Drawings and specifications herein comply to the best of the engineer's knowledge with all applicable codes at the time of design. Coordinate/verify (prior to bid) the requirements of the authority having jurisdiction over this project and bring any discrepancies to the engineer's attention at least seven (7) days prior to bid. No changes in contract cost will be acceptable, after the bid, for work and/or equipment required to comply with the authority having jurisdiction.

- E. Circuit routing for this system is not necessarily shown on the project drawings. Provide raceways, wiring and cabling required for a complete and fully functional system as intended by these specifications in accordance with division 26 requirements. Provide a properly sized, flush

mounted outlet box for every device. Size and route raceways to accommodate the proper installation of the system cabling. T-Tapped cabling shall not be acceptable. In locations where raceway and/or conduit is not accessible after completion of the project, conduit shall be routed from device to device or fire rated access panels shall be installed to provide access to junction and pull boxes. Routing of raceway from device to device shall only be acceptable where the wiring scheme of the system, as recommended by the manufacturer, requires cable to pass from device to device. Properly terminate each device according to the manufacturer's recommendations.

- F. Conduit will provide a pathway for all cables concealed within walls, run in exposed ceiling spaces, run in inaccessible ceiling spaces (Drop ceilings above 11' in height are also considered inaccessible), run exterior of the building, or subject to physical damage.
- G. This Specification describes a fully addressable, common fire alarm system, with remote fire alarm control units and power supplies for various buildings and portables.
- H. Provide and install the Fire Alarm system (including all equipment, wiring, etc.) in accordance with the Manufacturer's recommendations.
 - 1. Installation of devices shall be in accordance with the Manufacturer's requirements as well as the requirements of the Contract Documents. Recommendations by the Manufacturer for the proper installation of the Fire Alarm system and its equipment shall not preclude the requirement to comply with the requirements of the Contract Documents.
 - 2. Termination of Fire Alarm circuits shall be in accordance with the Manufacturer's recommendations, applicable requirements of the National Electric Code (NFPA 70), National Fire Alarm Code (NFPA 72), ADA, other applicable Codes and the Contract Documents.
 - 3. Voice evacuation audio circuits (25 or 70V) shall be run in separate raceways from Fire Alarm data loops and other system circuits where the potential exists for interference or adverse effect upon the proper operation of the any Fire Alarm equipment, circuit or the system as a whole.
 - 4. Ensure that prior to bidding the project the raceway requirements for the project. Claims after award of the project in regard to additional raceway required either by the Fire Alarm System Manufacturer's recommendations for proper installation of the system and its associated equipment, or for compliance with the requirements of the Contract Documents, shall not be allowed.
 - 5. Note that the drawings show Fire Alarm Control Units (FACU) in various locations. FACU's are intended to be equipment (remote control panels, power supplies, addressable modules, power, grounding, and any other equipment or materials) necessary for a remote extension of the Fire Alarm System. FACU's shall be connected to the campus main FACU via fiber optic interface specifically recommended by the Fire Alarm manufacturer and required to meet the intent of the project documents. An individual FACU shall provide the necessary circuitry (Notification Appliance Circuits (NAC), Signal Line Circuits (SLC), DC power circuits required by various devices, etc.) to the Fire Alarm devices within its coverage area. The FACU shall provide interconnection services between the device circuits in its area of coverage and the FACU just as if those device circuits were directly connected to the main FACU. All FACU's will be connected to the main FACU via a fiber connection only.

1.5 DEFINITIONS

- A. LED: Light-emitting diode.

- B. NICET: National Institute for Certification in Engineering Technologies.
- C. Definitions in NFPA 72 apply to fire alarm terms used in this Section.

1.6 SYSTEM DESCRIPTION

- A. Noncoded addressable system, with automatic sensitivity control of certain smoke detectors and multiplexed signal transmission, dedicated to fire-alarm service only. The system shall include but not be limited to:
 - 1. Main Fire Alarm Control Unit (FACU) including all required power supplies
 - 2. Fire Alarm Annunciator Panel (FAAP)
 - 3. Analog Dialer
 - 4. Manual Pull Stations
 - 5. Smoke Detectors
 - 6. Duct Detectors
 - 7. Heat Detectors
 - 8. Combination Audible/Visual devices (indoor and outdoor weatherproof as indicated on the drawings)
 - 9. Visual devices (indoor and outdoor weatherproof as indicated on the drawings)
 - 10. Remote fire alarm control units (Network Nodes)
 - 11. Remote power supplies (Remote power supplies shall be in a UL Listed assembly and be provided by the same manufacturer as the Fire Alarm Control Panel (FACU)).
 - 12. Surge Suppression
 - 13. Programming.
 - 14. Grounding
 - 15. Wire and cable labeling.
 - 16. Electrical power required to comply with all functions and operations called for in this section of the specifications. Provide all 120 VAC circuits as required.
 - 17. Conduit, wire, wire fittings, terminal cabinets with plywood and terminal strips, and all accessories required to provide a complete operating system.
 - 18. A complete and accurate schematic/drawing of the fire alarm system to be placed adjacent to the fire alarm annunciator panel and the main fire alarm panel.
- B. Provide all equipment (raceways, wire/cable, circuit breakers, modules, relays, etc.) necessary, and as required by applicable code, to accomplish incidental functions of the fire alarm system including but not limited to the following:
 - 1. Elevator recall, control, and/or shutdown.
 - 2. Monitoring of Sprinkler System and/or Fire Protection System Flow and Tamper switches.
 - 3. Monitoring of Sprinkler System and/or Fire Protection System Valve Supervisory switches.
 - 4. Monitoring of Post Indicator Valve (PIV) switches.
 - 5. Gas/Fuel valve shutoff.
 - 6. HVAC system control and/or shutdown.
 - 7. Ventilation system (supply fans, exhaust fans, fan terminal boxes, etc.) control and/or shutdown.
 - 8. Control of fire, smoke, and/or combination fire/smoke dampers.
 - 9. Fire suppression and or extinguishing systems.
 - 10. Monitoring of kitchen hood fire suppression systems
 - 11. Control of fire and/or smoke doors, dampers, shutters, etc.
 - 12. Control of door hold open devices.
 - 13. Connection to UL Listed communicator via data drop.

- C. Fire alarm system shall not share a raceway, junction box, enclosure, manhole or device with any other system.
- D. Provide terminal cabinets sized to house terminal strips and surge suppression equipment.
- E. Surge Suppression
 - 1. Provide equipment on the AC voltage supply and other lines taking care to arrest damaging electrical transient and spikes which can cause damage to the microprocessor components of the system. Central office telephone lines shall have equipment installed to arrest high voltages from electrical and/or lightning from entering the system and causing damage.
 - 2. Provide and install all materials, labor and auxiliaries required to furnish and install complete surge suppression for the protection of building fire alarm system from the effects of induced transient voltage surge and lightning discharge as indicated on drawings or specified in this section.
 - 3. Provide surge suppression equipment at the following locations:
 - a. On each conductor pair and cable sheath entering or leaving a building.
 - b. On each conductor associated with fire protection (sprinkler) system fire alarm connections.
 - c. On any and all telephone lines.
 - d. In other locations where equipment sensitivity to surges and transients requires additional protection beyond that inherent to the design of the equipment. Where equipment being protected has internal surge suppression equipment, the surge protection equipment herein specified is required to be installed in addition to internal equipment protection.

1.7 PERFORMANCE REQUIREMENTS

- A. Comply with NFPA 72.
- 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. Verified automatic alarm operation of smoke detectors.
 - 5. Automatic sprinkler system water flow.
 - 6. Hood fire suppression system
 - 7. Fire extinguishing system operation.
 - 8. Fire standpipe system.
- C. Fire alarm signal shall initiate the following actions:
 - 1. Alarm notification appliances shall operate continuously.
 - 2. Identify alarm at fire alarm control units and remote annunciators.
 - 3. Transmit an alarm signal to the remote alarm receiving station.
 - 4. Release fire and smoke doors held open by magnetic door holders.
 - 5. Activate voice/alarm communication system.
 - 6. Elevator recall (primary and secondary)
 - 7. Activate emergency lighting control.
 - 8. Release smoke vents (only if stage detectors are activated)
 - 9. Gas valve shut off
 - 10. Switch heating, ventilating, and air-conditioning equipment controls to fire alarm mode.

11. Close smoke dampers in air ducts of system serving zone where alarm was initiated.
12. Record events in the system memory.
13. Record events by the system printer.

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.
2. Fire-pump power failure, including a dead-phase or phase-reversal condition.
3. Fire pump alarm
4. Elevator shunt trip power monitor
5. Duct Detectors

E. System trouble signal initiation shall be by one or more of the following devices or actions:

1. Open circuits, shorts and grounds of wiring for signaling line and notification-appliance circuits.
2. Opening, tampering, or removal of alarm-initiating and supervisory signal-initiating devices.
3. Loss of primary power at fire alarm control unit.
4. Ground or a single break in fire alarm control unit internal circuits.
5. Abnormal ac voltage at fire alarm control unit.
6. A break in standby battery circuitry.
7. Failure of battery charging.
8. Abnormal position of any switch at fire alarm control unit or annunciator.
9. Low-air-pressure switch operation on a dry-pipe or preaction sprinkler system.

F. Under fire drill, the following actions shall occur:

1. Only the notification appliances and door release shall operate under fire drill condition.

G. System Trouble and Supervisory Signal Actions:

1. Annunciate at fire alarm control unit and remote annunciators.
2. Record the event on system printer.
3. Transmit signal to the remote receiving station

H. ZONING

1. Initiation Zones.
 - a. Regardless of the number of zones shown on drawings, the minimum alarm zones required are:
 - 1) One per building, per floor for pull stations.
 - 2) One per building, per floor for automatic devices.
 - 3) One for each duct smoke detector).
 - 4) Each device shall be individually annunciated/addressable.
2. Notification Zones.
 - a. Regardless of the number of zones shown on drawings the minimum notification zones (horns and strobe lights) required are:
 - 1) One (or more) circuit(s) for administration building
 - 2) One (or more) circuit(s) for exterior horns
 - 3) One (or more) circuit(s) for remainder of campus.
3. Breakdown circuits as required for load and distances involved.

1.8 SUBMITTALS

A. General Submittal Requirements:

1. Submittals shall be approved by authorities having jurisdiction prior to submitting them to Architect.
2. Shop Drawings shall be prepared by persons with the following qualifications:
 - a. Trained and certified by manufacturer in fire-alarm system design.
 - b. NICET-certified fire-alarm technician, Level III minimum.
 - c. Licensed or certified by authorities having jurisdiction.

B. Product Data: For each type of product indicated.

C. Shop Drawings: For fire-alarm system. Include plans, elevations, sections, details, and attachments to other work.

1. Comply with recommendations in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter in NFPA 72.
2. Include voltage drop calculations for notification appliance circuits.
3. Include battery-size calculations.
4. Include performance parameters and installation details for each detector, verifying that each detector is listed for complete range of air velocity, temperature, and humidity possible when air-handling system is operating.
5. Include plans, sections, and elevations of heating, ventilating, and air-conditioning ducts, drawn to scale and coordinating installation of duct smoke detectors and access to them. Show critical dimensions that relate to placement and support of sampling tubes, detector housing, and remote status and alarm indicators. Locate detectors according to manufacturer's written recommendations.
6. Include voice/alarm signaling-service equipment rack or console layout, grounding schematic, amplifier power calculation, and single-line connection diagram.
7. Include floor plans to indicate final outlet locations showing address of each addressable device. Show size and route of cable and conduits.

D. Delegated-Design Submittal: For smoke and heat detectors indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Drawings showing the location of each smoke and heat detector, ratings of each, and installation details as needed to comply with listing conditions of the detector.
2. Design Calculations: Calculate requirements for selecting the spacing and sensitivity of detection, complying with NFPA 72.

E. Qualification Data: For qualified Installer.

F. Field quality-control reports.

G. Operation and Maintenance Data: For fire-alarm systems and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:

1. Comply with the "Records" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.
2. Provide "Record of Completion Documents" according to NFPA 72 article "Permanent Records" in the "Records" Section of the "Inspection, Testing and Maintenance" Chapter.

3. Record copy of site-specific software.
4. Provide "Maintenance, Inspection and Testing Records" according to NFPA 72 article of the same name and include the following:
 - a. Frequency of testing of installed components.
 - b. Frequency of inspection of installed components.
 - c. Requirements and recommendations related to results of maintenance.
 - d. Manufacturer's user training manuals.
5. Manufacturer's required maintenance related to system warranty requirements.
6. Abbreviated operating instructions for mounting at fire-alarm control unit.
7. Copy of NFPA 25.

H. Software and Firmware Operational Documentation:

1. Software operating and upgrade manuals.
2. Program Software Backup: On magnetic media or compact disk, complete with data files.
3. Device address list.
4. Printout of software application and graphic screens.

1.9 QUALITY ASSURANCE

A. Installer Qualifications:

1. Installation shall be by personnel certified by NICET as fire-alarm Level III technician. Company specializing in installing the products specified in this section with minimum ten (10) years experience.
2. The Installer shall be currently licensed by the Electrical Contractors' Licensing Board as a Certified Alarm System Contractor I (EF).
3. The installing Contractor shall be a direct sales division of, or the authorized and designated distributor for, a fire alarm system manufacturer.
4. Installing Contractor shall maintain a local staff of specialists, including a Fire Alarm Planning Superintendent, for planning, installation, and service.
5. The installing Contractor shall maintain an office within fifty (50) miles of the project with capability to provide emergency service 7-days-a-week, 24 hour days. The installing Contractor shall have been actively engaged in the business of selling, installing and servicing fire alarm systems for at least ten (10) consecutive years going back from date of bid.

B. Source Limitations for Fire-Alarm System and Components: Obtain fire-alarm system from single source from single manufacturer. Components shall be compatible with, and operate as, an extension of existing system.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

D. NFPA Certification: Obtain certification according to NFPA 72 by an NRTL.

1.10 PROJECT CONDITIONS

- A. Interruption of Existing Fire-Alarm Service: Do not interrupt fire-alarm service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary guard service according to requirements indicated:
 - 1. Notify Construction Manager and Owner no fewer than two days in advance of proposed interruption of fire alarm service.
 - 2. Do not proceed with interruption of fire alarm service without Construction Manager' and Owner's written permission.

1.11 SEQUENCING AND SCHEDULING

- A. Existing Fire-Alarm Equipment: Maintain existing equipment fully operational until new equipment has been tested and accepted. As new equipment is installed, label it "NOT IN SERVICE" until it is accepted. Remove labels from new equipment when put into service and label existing fire-alarm equipment "NOT IN SERVICE" until removed from the building.
- B. Equipment Removal: After acceptance of new fire-alarm system, remove existing disconnected fire-alarm equipment and wiring.
- C. Provide any required temporary connections to keep all areas not under construction functional and tied to the campus fire alarm system. This includes all panels and devices.

1.12 SOFTWARE SERVICE AGREEMENT

- A. Comply with UL 864.
- B. Technical Support: Beginning with Substantial Completion, provide software support for One year.
- C. Upgrade Service: Update software to latest version at Project completion. Install and program software upgrades that become available within one year from date of Substantial Completion. Upgrading software shall include operating system. Upgrade shall include new or revised licenses for use of software.
 - 1. Provide 30 days' notice to Owner to allow scheduling and access to system and to allow Owner to upgrade computer equipment if necessary.

1.13 ADDITIONAL DEVICES FOR JURISDICTIONAL COMPLIANCE

- A. Prior to bid, review plans and specifications carefully for compliance with all codes and in particular, the ADA Requirements and NFPA 72. Include in bid price any devices required to provide a fully compliant system. Said additional devices shall be shown on shop drawings submitted by contractor.
- B. In addition to the above-mentioned devices, include in bid price the cost of installing twenty additional audible/visual notification devices (over and above those shown on drawings, required by specifications, or determined by system installed to be required) whose location/need may not become apparent until just prior substantial completion date. At least two weeks prior to substantial completion; system shall be fully operational. After system is

operational OCPS Safety Representative and the system installer shall review the placement of and coverage provided by visual and audible signals throughout the facility for compliance with all codes and in particular, the ADA Requirements and NFPA 72. Provide the additional devices at locations where the Architect/Engineer requests for complete coverage. The additional devices shall be installed and fully operational prior to date of Substantial Completion.

- C. After the project has had its first annual safety inspection the system installer shall install within one weeks notice any additional audible/visual signals that have been determined to be required during said inspection from the balance of the (20) twenty additional devices noted above. There shall be at no costs for these added devices provided the total does not exceed the balance remaining of the (20) twenty devices noted above. The final balance of the twenty additional devices included in bid price shall be turned over to the owner as spare material after any fire alarm issues identified during the first annual safety inspection are resolved.

1.14 MAINTENANCE SERVICE

- A. Furnish service and maintenance of fire alarm system for one (1) year from date of Substantial Completion.
 - 1. No charge shall be made for any labor, equipment, or transportation during this period to maintain functions.
 - 2. Respond to trouble call within twenty-four (24) hours after receipt of such call.
- B. Provide annual testing and inspection of fire alarm system at end of first year in accordance with NFPA 72. Correct any deficiencies found at no cost to the Owner. Affix fire alarm tag to panel.

1.15 WARRANTY

- A. Warrant the equipment to be new and free from defects in material and workmanship. Within one year from date of acceptance by owner, repair or replace any equipment found to be defective.
 - 1. No charges shall be made for any labor, equipment, or transportation during this period to maintain functions.
 - 2. Respond to trouble call within twenty-four (24) hours after receipt of such a call.
- B. Guarantee all wiring and raceways to be free from inherent mechanical or electrical defects for one (1) year from date of final acceptance of the system.
- C. Surge Suppression
 - 1. All surge suppression devices shall be warranted to be free from defects in materials and workmanship for a period of five (5) years.
 - 2. Any suppressor which shows evidence of failure or incorrect operation during the warranty period shall be repaired or replaced by the manufacturer and installer at no cost to the owner.
 - 3. Equipment that is damaged by surges during warrantee period shall be replaced at no expense to Owner.

1.16 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. Smoke Detectors: Three (3) of each type installed.
 - 2. Keys and Tools: Three (3) sets for access to locked and tamperproofed components.
 - 3. Surge Suppression devices: Three (3) of each type.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. United Technologies EST.
 - 2. Notifier by Honeywell
 - 3. Fire Control Instruments (FCI)
 - 4. Silent Knight Farenhyt IFP Series

2.2 RACEWAYS

- A. General:
 - 1. All raceways (conduits, wireways, pullboxes, outlet boxes, etc.) shall comply with applicable requirements of sections within Division 26 of these specifications.
 - 2. All raceways (conduits, wireways, pull boxes, outlet boxes, etc.) shall comply with all requirements of the manufacturer of the fire alarm system.
- B. Conduit: Comply with Section 26 05 33 except as noted below:
 - 1. Pull Cords: Install pull cords in all raceway runs that are installed without cable.
 - 2. Size: Minimum size shall be 3/4" conduit.
- C. Boxes:
 - 1. All outlet boxes, junction boxes, pull boxes, etc. shall comply with applicable section of these specifications.
 - 2. Boxes shall be sized as required by the fire alarm system manufacturer and NEC for cables and/or device installed.

2.3 TERMINATION CABINETS

- A. Terminal cabinets shall be N1 24" x 20"x 6" hinged cover minimum. See division 26 for additional requirements.

2.4 MAIN FIRE-ALARM CONTROL UNIT

A. General Requirements for main Fire-Alarm Control Unit:

1. Field-programmable, microprocessor-based, modular, power-limited design with electronic modules, complying with UL 864 and listed and labeled by an NRTL.
 - a. System software and programs shall be held in flash electrically erasable programmable read-only memory (EEPROM), retaining the information through failure of primary and secondary power supplies.
 - b. Include a real-time clock for time annotation of events on the event recorder and printer.
 - c. Master controller shall store all programming in non-volatile memory.
 - d. Master controller shall have an event log capable of storing a minimum of two hundred fifty-five (255) events in non-volatile memory.
 - e. Listed for use with smoke control systems.
2. Addressable initiation devices that communicate device identity and status.
 - a. Smoke sensors shall additionally communicate sensitivity setting and allow for adjustment of sensitivity at fire-alarm control unit.
 - b. Temperature sensors shall additionally test for and communicate the sensitivity range of the device.
3. Addressable control circuits for operation of mechanical equipment.
4. Control panel shall provide provisions for future expansion.

B. System Capability

1. Communication with addressable devices: The system must provide communication with all initiating and control devices individually. All of these devices are to be individually annunciated at the control panel. Annunciation shall include "Alarm", "Trouble", "Open", "Short", "Ground", "Device Fail" or "Incorrect Device" conditions for each point.
2. All addressable devices are to have the capability of being disabled or enabled individually.
3. Each Signal Line Circuit (SLC) two-wire loop shall be capable of addressing a minimum of ninety-nine (99) addressable devices and ninety-eight (98) monitor or control modules.
4. Identification of Addressable Devices: Each addressable device must be uniquely identified by an address code entered on each device at time of installation. The use of jumpers to set address will not be acceptable due to the potential of vibration and poor contact.
5. Wiring Type, Distances, Survivability and Configurations: The system must allow up to 2,500 feet wire length to the furthest addressable device. Style 4 Signaling Line Circuit (as defined by NFPA-72) communications will be provided.
6. System shall be capable of addressable devices and conventional devices within the same system.
7. All system circuits shall be inherently power limited per NEC 760.
8. System shall be capable of communication with a minimum of fifteen (15) remote fire alarm control unit locations via fiber optic network interface.

- ### C. Alphanumeric Display and System Controls: Arranged for interface between human operator at fire-alarm control unit and addressable system components including annunciation and supervision. Display alarm, supervisory, and component status messages and the programming and control menu.

1. Annunciator and Display: Liquid-crystal type, 3 line(s) of 80 characters, minimum.
 2. Keypad: Arranged to permit entry and execution of programming, display, and control commands and to indicate control commands to be entered into the system for control of smoke-detector sensitivity and other parameters.
- D. Circuits:
1. Initiating Device, Notification Appliance, and Signaling Line Circuits: NFPA 72, Class B.
 - a. Notification Appliance Circuits: Style Y.
 - b. Signaling Line Circuits: Style 4.
 - c. Install no more than 75 addressable devices on each signaling line circuit.
 2. Serial Interfaces: Two RS-232 ports for printers.
- E. Smoke-Alarm Verification:
1. Initiate audible and visible indication of an "alarm-verification" signal at fire-alarm control unit.
 2. Activate an NRTL-listed and -approved "alarm-verification" sequence at fire-alarm control unit and detector.
 3. Record events by the system printer.
 4. Sound general alarm if the alarm is verified.
 5. Cancel fire-alarm control unit indication and system reset if the alarm is not verified.
- F. Elevator Recall:
1. Smoke detectors at the following locations shall initiate automatic elevator recall. Alarm-initiating devices, except those listed, shall not start elevator recall.
 - a. Elevator lobby detectors except the lobby detector on the designated floor.
 - b. Smoke detector in elevator machine room.
 2. Elevator lobby detectors located on the designated recall floors shall be programmed to move the cars to the alternate recall floor.
 3. Heat detector or water flow devices connected to sprinkler in an elevator shaft and elevator machine room shall shut down elevators associated with the location without time delay.
 - a. Water-flow switch associated with the sprinkler in the elevator pit may have a delay to allow elevators to move to the designated floor.
- G. Door Controls: Door hold-open devices that are controlled by smoke detectors at doors in smoke barrier walls shall be connected to fire-alarm system.
- H. Remote Smoke-Detector Sensitivity Adjustment: Controls shall select specific addressable smoke detectors for adjustment, display their current status and sensitivity settings, and change those settings. Allow controls to be used to program repetitive, time-scheduled, and automated changes in sensitivity of specific detector groups. Record sensitivity adjustments and sensitivity-adjustment schedule changes in system memory, and print out the final adjusted values on system printer.
- I. Transmission to Remote Alarm Receiving Station: The main FACU shall automatically transmit alarm, supervisory, and trouble signals to alert fire department and/or Owner's remote

monitoring service. Provide dialer compatible with Owners central receiving station for emergency forces notification.

- J. Voice/Alarm Signaling Service: Central emergency communication system with redundant microphones, preamplifiers, amplifiers, and tone generators provided as a special module that is part of fire-alarm control unit.
1. Indicated number of alarm channels for automatic, simultaneous transmission of different announcements to different zones or for manual transmission of announcements by use of the central-control microphone. Amplifiers shall comply with UL 1711 and be listed by an NRTL.
 - a. Allow the application of and evacuation signal to indicated number of zones and, at same time, allow voice paging to the other zones selectively or in any combination.
 - b. Programmable tone and message sequence selection.
 - c. Standard digitally recorded messages for "Evacuation" and "All Clear."
 - d. Generate tones to be sequenced with audio messages of type recommended by NFPA 72 and that are compatible with tone patterns of notification appliance circuits of fire-alarm control unit.
 2. Status Annunciator: Indicate the status of various voice/alarm speaker zones and the status of firefighters' two-way telephone communication zones.
 3. Preamplifiers, amplifiers, and tone generators shall automatically transfer to backup units, on primary equipment failure.
- K. Modem
1. A modem shall be provided as an integral part of the main fire alarm control unit (FACU). The modem shall provide the Owner with the ability to accomplish the following functions:
 - a. View device sensitivity information.
 - b. View system activity in real time.
 - c. Access and view the system history log.
 2. Modem shall not allow changes to system programming.
 3. Modem shall operate at a minimum speed of 9600 baud.
 4. Modem shall provide an RJ-11 connector for connection to a telephone line.
 5. Coordinate with the Premise Distribution System (PDS) for interconnection to a telephone line.
 6. The modem shall mount inside the main fire alarm control unit (FACU)
- L. Primary Power: 24-V dc obtained from 120-V ac service and a power-supply module. Initiating devices, notification appliances, signaling lines, trouble signals, supervisory signals supervisory and digital alarm communicator transmitters shall be powered by 24-V dc source.
1. Alarm current draw of entire fire-alarm system shall not exceed 80 percent of the power-supply module rating.
- M. Secondary Power: 24-V dc supply system with batteries, automatic battery charger, and automatic transfer switch.
1. Batteries: Sealed lead calcium.
- N. Instructions: Computer printout or typewritten instruction card mounted behind a plastic or glass cover in a stainless-steel or aluminum frame. Include interpretation and describe appropriate response for displays and signals. Briefly describe the functional operation of the system under

normal, alarm, and trouble conditions. Provide a building floor plan (placard) next to the Fire Alarm Annunciator to indicate zone locations.

2.5 FIRE ALARM CONTROL UNIT

- A. Fire alarm control units will have all of the capabilities of the main fire alarm control unit except for the following functions.
1. Transmission to Remote Alarm Receiving Station
 2. Print out of events
 3. Modem

2.6 MANUAL FIRE-ALARM BOXES

- A. General Requirements for Manual Fire-Alarm Boxes: Comply with UL 38. Boxes shall be finished in red with molded, raised-letter operating instructions in contrasting color; shall show visible indication of operation; and shall be mounted on recessed outlet box. If indicated as surface mounted, provide manufacturer's surface back box.
1. Double-action mechanism requiring two actions to initiate an alarm, pull-lever type; with integral addressable module arranged to communicate manual-station status (normal, alarm, or trouble) to fire-alarm control unit.
 2. Station Reset: Upon actuation, they shall not be restorable to normal except by use of a key. The key shall also allow stations to be tested nondestructively.
 3. The stations shall be constructed of metal, with operating directions provided on the cover in highlighted, embossed lettering. The words "FIRE ALARM" shall appear on the door in embossed letters one-half inch high or larger. Mount at 48" above finished floor to top and in accordance with NFPA and handicap standards.

2.7 SYSTEM SMOKE DETECTORS

- A. General Requirements for System Smoke Detectors:
1. Comply with UL 268; operating at 24-V dc, nominal.
 2. Detectors shall be two-wire type.
 3. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.
 4. Base Mounting: Detector and associated electronic components shall be mounted in a twist-lock module that connects to a fixed base. Provide terminals in the fixed base for connection to building wiring.
 5. Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore them to normal operation.
 6. Integral Visual-Indicating Light: LED type indicating detector has operated.
 7. Remote Control: Unless otherwise indicated, detectors shall be analog-addressable type, individually monitored at fire-alarm control unit for calibration, sensitivity, and alarm condition and individually adjustable for sensitivity by fire-alarm control unit.
 - a. Provide multiple levels of detection sensitivity for each sensor.
- B. Photoelectric Smoke Detectors:
1. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.

2. Field adjustment of the sensitivity shall be possible when conditions require a change.
3. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:
 - a. Primary status.
 - b. Device type.
 - c. Present average value.
 - d. Present sensitivity selected.
 - e. Sensor range (normal, dirty, etc.).

C. Duct Smoke Detectors: Photoelectric type complying with UL 268A.

1. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.
2. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:
 - a. Primary status.
 - b. Device type.
 - c. Present average value.
 - d. Present sensitivity selected.
 - e. Sensor range (normal, dirty, etc.).
3. Weatherproof Duct Housing Enclosure: NEMA 250, Type 4X; NRTL listed for use with the supplied detector.
4. Detector shall provide detection of combustion gases and smoke in air conditioning ducts in compliance with NFPA 90A. Detector shall be UL-listed specifically for the use in air handling systems.
5. Each sensor shall have multiple levels of detection sensitivity.
6. Sampling Tubes: Design and dimensions as recommended by manufacturer for specific duct size, air velocity, and installation conditions where applied.
7. Whether shown on drawings or not, a remote alarm indicator/test station shall be provided for each duct mounted smoke detector to annunciate smoke detector operation remotely. Mount unit in ceiling or wall near respective remote smoke detectors (in an occupied space).
8. Provide duct mounted smoke detectors in both the supply and return air ducts of air handlers and "cross zone" so that either single detector will only initiate a "trouble/supervisory" alarm and shut down the air handler. Duct detectors are not to sound a general alarm.

2.8 HEAT DETECTORS

- A. General Requirements for Heat Detectors: Analog addressable heat detectors that comply with UL 521, as called for on drawings. Combination detector head and twist-lock base shall be UL-listed compatible with a UL-listed fire alarm panel.
- B. Heat detector shall have a flashing, status-indicating LED for visual supervision. When the detector is actuated, the flashing LED will latch on steady and at full brilliance. Detector may be reset by actuating the control panel reset switch.
- C. Heat Detector, Combination Type: Actuated by either a fixed temperature of 135 deg F (57 deg C) or a rate of rise that exceeds 15 deg F (8 deg C) per minute unless otherwise indicated.
 1. Mounting: Twist-lock base interchangeable with smoke-detector bases.

2. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.
- D. Heat Detector, Fixed-Temperature Type: Actuated by temperature that exceeds a fixed temperature of 135 deg F (57 deg C).
1. Mounting: Twist-lock base interchangeable with smoke-detector bases.
 2. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.
 3. Provide 190 deg F (88 deg C) in rooms with high heat sources such as the Kiln room.
 4. Detectors shall have a smooth ceiling rating of 900 square feet.
 5. Where indicated on the drawings, provide heat detectors rated, by the manufacturer, as explosion proof. If not an integral part of the heat detector assembly, the addressable module shall be located outside the area protected by the explosion proof heat detector (but interior to the building) in an accessible area.

2.9 NOTIFICATION APPLIANCES

A. AUDIBLE NOTIFICATION DEVICES

1. Audible notification devices shall be wall mounted at each location designated on the drawings and/or as specified herein.
2. The audible notification device shall include screw terminals for in-out field wiring. The device shall surface mount to a standard 4" sq. x 2 -1/8" backbox.
3. The audible notification devices shall be U.L. listed for fire protective service and shall provide 24 VDC inputs and sound output of not less than 75 dBA at 10 feet, or more than 120 dBA at the minimum hearing distance from the audible appliance.
 - a. Audible notification device shall compliant with ANSI S3.41 for signal character conformance.
4. Audible notification devices located on the exterior of a building, or in a damp or wet location, shall be a weatherproof version and rated, by the manufacturer, for use in wet locations.

B. AUDIBLE/VISUAL NOTIFICATION DEVICES

1. Audible/visual notification devices shall be wall mounted at each location designated on the drawings and/or as specified herein.
2. Audible/visual notification device shall include screw terminals for in-out field wiring. The device shall surface mount to a standard 4" sq. x 2 -1/8" backbox.
3. Audible portion of the audible/visual notification devices shall be U.L. listed for fire protective service and shall provide 24 VDC inputs and sound output of not less than 75 dBA at 10 feet, or more than 120 dBA at the minimum hearing distance from the audible appliance.
 - a. Audible portion of the audible/visual notification device shall compliant with ANSI S3.41 for signal character conformance.
4. Audible portion of audible/visual notification devices located on the exterior of a building, or in a damp or wet location, shall be a weatherproof version and rated, by the manufacturer, for use in wet locations.
5. Visual portion of the audible/visual notification devices shall comply with the NFPA 72 which includes the following:

- a. More than two visible notification appliances in the same room or adjacent space within the field of view must flash in synchronization. This requirement shall not preclude synchronization of appliances that are not within the same field of view.
6. A suitable polycarbonate cover shall be provided to protect devices at locations where they may be subject to damage such as Gymnasiums.

C. VOICE/TONE SPEAKERS:

1. Comply with UL 1480, "Speakers for Fire Protective Signaling."
2. Speakers: Compression-driver type with flared projectors having a frequency response of 400 to 4000 Hz; equipped with a multiple tap, varnish-impregnated, sealed, matching transformer. Match transformer tap range and speaker power rating to the acoustical environment of the speaker location.
3. High-Range Speaker Units: Rated 2-15 watts.
4. Low-Range Speaker Units: Rated .25-2 watts.
5. Speaker Mounting: Recessed.
6. Combination speaker/strobe appliances shall be provided for all wall mounted devices. Ceiling units shall be fully recessed and speaker only. Ceiling speaker shall be white round perforated. Wall units shall be red square perforated.

D. VISUAL NOTIFICATION DEVICES

1. Visual notification devices shall be wall mounted at each location designated on the drawings and/or as specified herein. Visual notification devices shall be of the flashing type in compliance with Americans with Disabilities Act.
2. Visual portion of the audible/visual notification devices shall comply with the NFPA 72 which includes the following:
 - a. More than two visible notification appliances in the same room or adjacent space within the field of view must flash in synchronization. This requirement shall not preclude synchronization of appliances that are not within the same field of view.
 - b. A suitable polycarbonate cover shall be provided to protect devices at locations where they may be subject to damage such as Gymnasiums.

2.10 MAGNETIC DOOR HOLDERS

- A. Description: Units are equipped for wall or floor mounting as indicated and are complete with matching doorplate.
 1. Electromagnet: Requires no more than 3 W to develop 25-lbf (111-N) holding force.
 2. Wall-Mounted Units: Flush mounted unless otherwise indicated.
 3. Rating: 24-V ac or dc.
- B. Material and Finish: Match door hardware.

2.11 REMOTE ANNUNCIATOR (FAAP)

- A. Description: Annunciator functions shall match those of fire-alarm control unit for alarm, supervisory, and trouble indications. Manual switching functions shall match those of fire-alarm control unit, including acknowledging, silencing, resetting, and testing.
 1. Mounting: Flush cabinet, NEMA 250, Type 1.

- B. Display Type and Functional Performance: Alphanumeric display and LED indicating lights shall match those of fire-alarm control unit. Provide controls to acknowledge, silence, reset, and test functions for alarm, supervisory, and trouble signals. Provide button for fire drill.

2.12 ADDRESSABLE INTERFACE DEVICE

- A. Description: Microelectronic monitor module, NRTL listed for use in providing a system address for alarm-initiating devices for wired applications with normally open contacts.
- B. Integral Relay: Capable of providing a direct signal to elevator controller to initiate AHU shutdown, elevator recall, to circuit-breaker shunt trip for power shutdown, smoke door operation, smoke damper operation, audio system mute function, or other required functions.

2.13 PULL STATION SECURITY COVER

- A. Provide where pull station devices are required to be protected as indicated on the drawings.
- B. Shall be UL Listed.
- C. Constructed of clear polycarbonate.
- D. Provide with battery operated warning horn.
- E. For flush or surface mount devices.
- F. Provide with weather gasket.
- G. Spacers for additional depth as required.
- H. Provide with tamper proof screws.
- I. Design criteria:
 - 1. Safety Technology International, Inc. #1100 Series.
- J.

2.14 DEVICE GUARDS

- A. Description: Welded wire mesh of size and shape for the manual station, smoke detector, gong, or other device requiring protection.
 - 1. Factory fabricated and furnished by manufacturer of device.
 - 2. Finish: Paint of color to match the protected device.

2.15 SURGE SUPPRESSION

- A. Non-Addressable Initiation Devices:

1. Plug-in replacement modular design with associated female wiring connector.
2. U.L. 497B listed and labeled.
3. Multi-stage hybrid protection circuit.
4. Fail short/fail safe.
5. Surge Capacity: 10KA with 8 x 20 μ s waveform, 500A per line with 10 x 700 μ s waveform.
6. Clamp Voltage: 150% of circuit peak operating voltage with 100 amp 10 x 700 μ s waveform.
7. Maximum Continuous Operating Voltage: 125% of peak operating voltage, minimum.
8. Capacitance: 1500 pf.

B. Addressable Initiation Devices and Data Loops:

1. Plug-in replacement modular design with associated female wiring connector.
2. U.L. 497B listed and labeled.
3. Multi-stage hybrid protection circuit.
4. Fail short/fail safe.
5. Surge Capacity: 10KA with 8 x 20 μ s waveform, 500A per line with 10 x 700 μ s waveform.
6. Clamp Voltage: 150% of circuit peak operating voltage with 100 amp 10 x 700 μ s waveform.
7. Maximum Continuous Operating Voltage: 125% of peak operating voltage, minimum.
8. Capacitance: 50 pf.

C. Horn, Strobe, Control Power (Low Voltage):

1. Plug-in replacement modular design with associated female wiring connector.
2. U.L. 497B listed and labeled.
3. Multi-stage hybrid protection circuit.
4. Fail short/fail safe.
5. Surge Capacity: 5KA with 8 x 20 μ s waveform.
6. Clamp Voltage: 150% of circuit peak operating voltage with 100 amp 10 x 700 μ s waveform.
7. Maximum Continuous Operating Voltage: 125% of peak operating voltage, minimum.
8. Series Resistance: 0.2 ohms total per pair.

D. Power Circuit (120 volt):

1. U.L. 1449 listed.
2. 15 amp, 120V rated.
3. Suppressors shall be tested per IEEE, C62.41-1991 for Categories A and B.
4. Normal mode (L-N), and common mode (L+N-G) protection.
5. Internal fusing.
6. Hybrid design.
7. Indicators for normal operation and failure indication.
8. Enclosure:
 - a. Fire retardant high impact, phenolic or plastic housing or metal enclosure.
9. Clamping voltage U.L. 1449, Line to Neutral, Category B Impulse At (3KA, 8 x 20 μ s): 385V @ 120V.
10. Maximum Surge Capacity: 20,000 amps.
11. Maximum Continuous Operating Voltage: 115% of line voltage.
12. Provide hardwire connection or add 15 amp receptacle device to hardwired devices to match equipment being protected and maintain U.L. listing.
13. Provide additional 15 amp in-line fusing as required to comply with U.L. and the N.E.C. when connected to a 20 amp, 120V circuit.

2.16 CABLE

- A. Conductor: 98% conductivity, stranded copper with maximum of 7 strands. Stranded conductors shall have a compression lug installed at every end. Wrapping twisted strands at terminal block screw is not acceptable. As an acceptable equivalent, stranded conductors without crimp-on lugs may be terminated into terminal strips of box-lug connectors. Solid copper is not acceptable.
- B. Insulation: A type accepted by NEC for the application. All cable shall be UL listed for fire-protective signaling application. Communication, Class 3 or Multi-Purpose cables shall not be substituted for FP cable types.
- C. Size: All conductors shall be sized as prescribed by the system manufacturer, with following minimums:
 - 1. Multiplex Signaling Line Circuit: AWG #14, shielded twisted pair.
 - 2. Notification Circuits, Devices: AWG #14.
 - 3. Initiating Circuits, Hard-Wired Devices: AWG #14.
 - 4. Initiating Circuits, Addressable Devices: AWG #14, shielded twisted pair.
 - 5. Provide larger conductors where required to maintain voltage drop or signal strength within acceptable limits. Provide cable as required by the manufacturer, as specified elsewhere in these specifications, and to provide a complete, fully operational, UL Listed Fire Alarm system.
- D. Fire alarm system cables installed in interior, exterior and/or underground raceways shall comply with the applicable sections of N.E.C. Articles 760, 770 and 800.
- E. Wiring shall be sized to allow a maximum of 8% voltage drop for all notification circuits and 3% for all A/C circuits.
- F. Wiring color code shall be as follows:
 - 1. Horns/Strobes Black/Red
 - 2. Door Holders White
 - 3. A.H.S.D. Purple
 - 4. Gas Shut-Off Pull Stations Orange
 - 5. Addressable Twisted Pair Data Wire
 - 6. Hard-Wired Brown/Blue

PART 3 - EXECUTION

3.1 EQUIPMENT INSTALLATION

- A. Comply with NFPA 72 for installation of fire-alarm equipment.
- B. Equipment Mounting: Install fire-alarm control unit on finished floor with tops of cabinets not more than 72 inches (1830 mm) above the finished floor.
- C. Connecting to Existing Equipment: Verify that existing fire-alarm system is operational before making changes or connections.
- D. Smoke- or Heat-Detector Spacing:

1. Comply with NFPA 72, "Smoke-Sensing Fire Detectors" Section in the "Initiating Devices" Chapter, for smoke-detector spacing.
 2. Comply with NFPA 72, "Heat-Sensing Fire Detectors" Section in the "Initiating Devices" Chapter, for heat-detector spacing.
 3. Smooth ceiling spacing shall not exceed 30 feet (9 m).
 4. Spacing of detectors for irregular areas, for irregular ceiling construction, and for high ceiling areas shall be determined according to Appendix A in NFPA 72.
 5. HVAC: Locate detectors not closer than 5 feet (1.5 m) from air-supply diffuser or return-air opening.
 6. Lighting Fixtures: Locate detectors not closer than 12 inches (300 mm) from any part of a lighting fixture.
- E. Duct Smoke Detectors: Comply with NFPA 72 and NFPA 90A. Install sampling tubes so they extend the full width of duct.
- F. Heat Detectors in Elevator Shafts: Coordinate temperature rating and location with sprinkler rating and location.
- G. Audible Alarm-Indicating Devices: Install not less than 90" AFF or not less than 6 inches (150 mm) below the ceiling. Install bells and horns on flush-mounted back boxes with the device-operating mechanism concealed behind a grille.
- H. Visible Alarm-Indicating Devices: Install adjacent to each alarm bell or alarm horn, visual indicating unit not less than 80 in AFF and not more than 96" AFF.
- I. Device Location-Indicating Lights: Locate in public space near the device they monitor. All concealed detectors shall be provided with a remote indicating lamp and test switch installed in an occupied space (corridor, etc.) on wall or on the ceiling grid indicating the type of detector and the zone to which it is connected. Label shall be red with white lettering.
- J. Duct detectors shall be installed in accordance with NFPA 90A. All brackets and hardware shall be provided as required to install detector housing in correct position. All detector housings shall be sealed as required to prevent air leakage between duct and housing. Sampling tubes of proper length shall be provided and installed to match duct width at the installed location.
- K. Fire-Alarm Control Unit: Surface mounted, with tops of cabinets not more than 72 inches (1830 mm) above the finished floor.
- L. Annunciator: Install with top of panel not more than 72 inches (1830 mm) above the finished floor.
- M. Provide all work required for a complete system including complete system testing and checkout. All components shall be properly mounted and wired. The installation of this system shall comply with the directions and recommendations of authorized factory representatives.
- N. Provide wiring, cabling, raceways, and electrical boxes in accordance with manufacturer's written instructions.
- O. Components shall be electrically "burned-in" by operating the component at full power for a period as recommended by the manufacturer.
- P. Installation shall be done in a neat workmanlike fashion by a firm regularly engaged in Fire Alarm Installation and Service.

- Q. The installation and inspection of all fire detection and fire alarm devices and systems shall be performed by, or under the direct on-site supervision of, a licensed fire alarm technician or a fire alarm planning superintendent who shall certify the work upon completion of the activity. The certifying licensee shall be present for the final test prior to certification.
- R. As-built plans and wiring diagrams shall bear the signature and license number of the licensed fire alarm planning superintendent, the date of installation and the name, address, and certificate-of-registration number of the registered firm.
- S. All components shall be completely wired. System shall be fully operable when main power service has failed and the Emergency Standby Generator has assumed emergency system loads. This shall require that any devices which required 120 volt power shall receive supply from an emergency 120 volt source.
- T. Make addressable connections with a supervised interface device to the following devices and systems. Install the interface device less than 3 feet (1 m) from the device controlled. Make an addressable confirmation connection when such feedback is available at the device or system being controlled.
 - 1. Alarm-initiating connection to smoke-control system (smoke management) at firefighter smoke-control system panel.
 - 2. Alarm-initiating connection to stairwell and elevator-shaft pressurization systems.
 - 3. Smoke dampers in air ducts of designated air-conditioning duct systems.
 - 4. Alarm-initiating connection to elevator recall system and components.
 - 5. Alarm-initiating connection to activate emergency lighting control.
 - 6. Alarm-initiating connection to activate emergency shutoffs for gas and fuel supplies.
 - 7. Supervisory connections at valve supervisory switches.
 - 8. Supervisory connections at low-air-pressure switch of each dry-pipe sprinkler system.
 - 9. Supervisory connections at elevator shunt trip breaker.
 - 10. Supervisory connections at fire-pump power failure including a dead-phase or phase-reversal condition.
 - 11. Supervisory connections at fire-pump engine control panel.
- U. Apply a compression lug, similar to T&B Sta-Kon Terminal, to all stranded conductors at terminations or use box-lug terminal strips.
- V. There shall be no wire splices. All wiring shall be continuous, uncut between devices and terminal blocks.

3.2 MANUAL PULL STATIONS

- A. Install at 48 inches to top above finished floor.
- B. All manual stations shall be in unobstructed locations.
- C. Install to comply with NFPA, ADA, and all handicap/accessibility code requirements.
- D. Provide, install, and connect additional pull stations (from that shown on drawings) as required to comply with above requirements.

3.3 AUDIBLE SIGNAL DEVICES, VISUAL SIGNAL DEVICES OR COMBINATION
AUDIBLE/VISUAL SIGNAL DEVICES

- A. Shall comply with NFPA, the Americans with Disabilities Act and other applicable handicap/accessibility codes including but not limited to the following:
 - 1. Wall mounted devices shall have their bottom edge of the visual indicating portion of the device mounted at 80 inches AFF.
 - 2. In general, no place in any room or space required to have a visual signal appliance shall be more than 50 ft. (15 m) from the signal (in the horizontal plane).
 - 3. No place in common corridors or hallways in which visual alarm signaling appliances are required shall be more than 50 ft. (15 m) from the signal. Placement of visual devices shall not be less than the requirements as specified by NFPA 72.

3.4 END-OF-LINE DEVICE

- A. Mount end-of-line device box with last device or separate box adjacent to last device in circuit.

3.5 AUXILIARY CONTROL RELAYS

- A. An auxiliary fire alarm relay used to control an emergency control device, e.g. motor controller for HVAC system fan or elevator controller shall be located within 3 ft. of the emergency control device.
- B. The installation wiring between the system panel and the auxiliary fire alarm relay shall be monitored for integrity.
- C. Auxiliary control relays shall be listed for use with fire alarm systems.

3.6 SPRINKLER FLOW SWITCHES

- A. Coordinate the electrical and operating characteristics of the flow switches with the fire alarm panel.
- B. Run conduit and wiring to the flow switches, and connect them so as to provide an operable supervised sprinkler alarm system per NFPA standards, and state and local codes.
- C. Provide all electrical including zones as required by authority having jurisdiction and codes.

3.7 SPRINKLER VALVE SUPERVISORY SWITCHES

- A. Coordinate the electrical and operating characteristics of the supervisory switches with the fire alarm panel.
- B. Run conduit and wiring to the supervisory switches, and connect them so as to provide an operable supervised sprinkler alarm system per NFPA standards, and state and local codes.
- C. Provide all electrical including zones as required by authority having jurisdiction and codes.

3.8 DOOR ELECTRIC LOCK AND HOLD-OPEN POWER SYSTEMS

- A. General: Provide 24V-dc low voltage power to all building doors with openers, hold-open devices, closers or electric locks. Refer to Architectural door hardware schedule for doors that may have electric holders or locks. Low voltage power supplies for door hardware shall be furnished separately from the fire alarm system. The fire alarm system shall only provide the unlocking or release control signals and auxiliary control relays at power supplies, in order to reduce power draw on fire alarm system power supplies and batteries.
- B. Low Voltage Power: Provide a low voltage transformer on each floor having doors with electric hardware. Transformer shall be 120-24V ac, sized as required to handle load served. Mount in a NEMA 1 enclosure above accessible corridor ceiling outside the first door closest to fire alarm riser. Provide transformer primary fusing to comply with N.E.C. Provide a 24V ac-24V dc rectifier on the secondary side of the transformer. Provide dedicated branch circuit from closest 120V normal power panel. Provide necessary interposing auxiliary control relay(s) to accept unlocking/release and restore signals from the fire alarm system.
- C. Wiring: Electric hardware shall be connected for fail-safe operation. Upon loss of normal power hardware shall unlock without unlatching. Hold-open doors shall release for closure. Restoration of hardware power shall be automatic after the fire alarm system unlock control is reset. Provide all wiring necessary to connect transformer. Provide all low voltage wiring to connect electric locks. Extend wiring down hinge side of stair door jam through hinge plate into door and through door to electric lock mechanism.
- D. Fire Alarm Unlocking Control: All door hardware circuits shall be controlled by fire alarm system. Upon receipt of signal from fire alarm system all door holders shall release and stair/egress door electric locks power system shall be disabled allowing all locks to unlock (without unlatching). Signal to activate shall be automatic fire alarm signal or manual command initiated in the building Fire Control Room. Manual unlock override command shall be through override system. Reference paragraph entitled "FIRE DEPARTMENT OVERRIDE CONTROL PANEL". Provide pilot light and 3-position override switch. ON position (illuminated red pilot light) shall initiate fail-safe operation. OFF position shall restore low voltage power. Provide separate override switch for door openers associated with Atrium Smoke Exhaust System.
- E. Mount outlet box for electric door holder to withstand 80 pounds (36.4 kg) pulling force.

3.9 GAS/FUEL SHUT-OFFS

- A. Whether shown on drawings or not provide gas/fuel shut-off systems for each and every gas/fuel supply as required by the applicable codes and standards.

3.10 ELEVATORS

- A. Operation of elevators under fire or other emergency conditions - elevators having a travel distance of 25 feet or more shall conform to the requirements of ANSI A17.1, Safety Code for Elevators and Escalators, as incorporated herein by reference.
- B. When an automatic sprinkler system is required to be installed throughout a building for complete fire protection coverage, the provisions of ANSI A17.1, which is incorporated herein by reference, shall be applicable. An accepted fixed temperature (135 degrees F.) heat detector shall be installed in the elevator machine room to automatically disconnect the main power supply to the affected elevator(s) prior to the application of water. The main power supply shall not be self-resetting. The activation of sprinklers outside of the hoistway or

machine room shall not disconnect the main power supply. The sprinkler head located in the elevator machine room shall have an activation temperature greater than the accepted fixed temperature heat detector.

- C. Provide detectors with auxiliary relay complete with tie into elevator controller as required by all codes, or provide separate zone.

3.11 CABLE IDENTIFICATION

- A. Provide and install permanent cable markers on all cables/wire lines, telephone lines, etc. at terminal strips, terminal cabinets and at main equipment.

3.12 INTERNET CONNECTION

- A. Provide a connection from a data outlet (RJ45 connector) mounted adjacent to the FACP to the nearest PDS rack for connection to the internet. Provide and install the DMP: XR-500 panel as required for communication to the OCPS proprietary supervising station.

3.13 SURGE PROTECTION

A. General

1. Provide, install and connect new surge suppression equipment as specified herein, including protection of equipment power source, cable/wire entering or leaving building housing, main fire alarm system equipment, ground lugs, #6 copper ground wire in 3/4" c. to existing main building service ground.
2. Extreme care shall be taken to assure a properly surge protected system.
3. Surge protection equipment must be selected to match the equipment being protected including wire sizes, operating volts, amps, and circuit impedance.
4. Installation of surge protection equipment and its grounding must be per manufacturer's recommendations to assure short and proper ground paths.

B. Equipment Selection

1. Coordinate with suppliers and installers of all equipment being protected and provide surge suppression equipment which meets these specifications on respective equipment, wires, etc.

C. Equipment Installation

1. Install surge suppression equipment per manufacturers recommendation at each wire terminal as noted under Part 1.
2. Install in surge suppression equipment terminal cabinets, etc. as required to facilitate installation of surge protection equipment and terminal points. Increase size of terminal cabinets (from that shown on drawings) to size required to facilitate installation of surge suppression equipment and terminal blocks.

D. Ground Installation

1. Ground Bus Connections.
 - a. Provide "local" ground bus in each terminal cabinet housing surge protection equipment (with lugs, etc. as required).

- b. Bond "local" ground bus to terminal cabinet with minimum #6 copper wire.
- c. Connect terminal cabinet "local" ground bus to "systems" ground bus with minimum #6 copper insulated wire (unless otherwise noted) in conduit.
- d. Note that "systems" ground bar is also to be used for power transformation ground (480V to 208V) where applicable.
2. Surge suppression equipment grounding.
 - a. Connect each surge suppressor to local ground bus in terminal cabinet with wire sized as recommended by manufacturer. Where "M" block type terminations/surge suppressors are used, bond ground rail to local ground bar with wire as recommended by manufacturer.
3. Conductors.
 - a. Bends in excess of 90 degrees in any grounding conductor shall not be permitted. A radius of 6 inches or greater shall be maintained on all bends.
 - b. Do not bundle unprotected conductors with protected conductors.
 - c. Conductors shall be kept as short as possible.
 - d. Conductors shall be secured at 12" intervals with an accepted copper clamp.
 - e. Grounding conductors shall be properly connected to the building service ground by accepted clamps.
4. Grounding Connectors
 - a. Connectors, splicers, and other fittings used to interconnect grounding conductors, bond to equipment or grounding bars, shall be accepted by NEC or U.L. for the purpose.
 - b. All connectors and fittings shall be of the Nicopress crimp or compression set screw type.
 - c. Special treatment to fittings, lugs, or other connectors of dissimilar material shall be applied to prevent electro-galvanic action.
5. Telephone Circuits
 - a. Systems utilizing telephone company pairs as a transmission medium shall be provided with a suppressor conforming to device in Part 2 of this specification.
 - b. Suppressors shall be installed at each point where interface is made to telephone company pairs.
 - c. In cases where a modem or other device is used to interface with the telephone circuit the following procedure shall apply:
 - 1) The suppressor shall be installed on the telephone line side of the modem or coupling device.

3.14 CONDUIT/BOX IDENTIFICATION

- A. Identify fire alarm conduit and boxes with red paint in exposed locations. Identify conduit in concealed locations with 4" mark of red paint every 4'-0" O.C.

3.15 DEMONSTRATION

- A. When system is complete it shall be demonstrated to Owner's Representative who shall be given complete instructions, spare parts, manuals and maintenance information.

3.16 SYSTEM TESTING

- A. Prior to certification of the fire alarm system, provide a complete test of the fire alarm system in accordance with NFPA 72, Test Methods.

- B. Perform a complete, functional, component by component test of the entire fire alarm and detection system. Provide a detailed step by step testing procedure which is unique to this project, reflecting the type of system and the number and location of all components.
- C. Perform a sensitivity test of all smoke detectors and duct detectors. Perform a calibration/test of heat sensors.
- D. Demonstrate the proper operation of each component as follows:
 - 1. Photoelectric, and duct smoke detectors: activate the detector with a "false smoke" product which has been specifically formulated for testing smoke detection systems.
 - 2. Heat detectors: activate the detector by utilizing the detector check button.
 - 3. Pull Stations: activate the station by operating the station in its normal mode.
 - 4. Audible and Visual Alarms: verify proper operation when the system is put into the alarm mode.
 - 5. Sprinkler Flow Switches: open the sprinkler system's inspection test valve. Verify that the flow switch sends an alarm signal within the allowed time corresponding to the switch's time delay setting.
 - 6. Fire Alarm Panels: functionally check-out and test the panel per the manufacturer's written instructions. Demonstrate the proper operation of each modular component. Demonstrate automatic power change to batteries and back to building power upon a drop in voltage below the voltage threshold as specified by the panel manufacturer.
- E. Demonstrate the supervisory function at each device loop circuit, and at all single component wiring runs such as for the sprinkler valve supervisory switches.

3.17 CERTIFICATION

- A. After completion of the installation of the system, the licensee shall complete a NFPA Inspection and Testing form. The Inspection and Testing form format shall be as indicated in NFPA 72, Inspection and Testing Form. When an Inspection and Testing form has been completed, legible copies shall be distributed as directed by the Authority Having Jurisdiction.
- B. After an installation has been complete, affix a Fire Alarm Tag to the control panel. The Fire Alarm Tag is in addition to the Inspection and Testing form. Protect the Fire Alarm Tag from vandalism by applying pressure sensitive label; do not use a "tie-on" tag. It shall be as required in the Fire Safety Rules.

3.18 OWNER'S INSTRUCTION:

- A. Provide instruction to the Owner's designated personnel upon completion of the system installation. Instruction shall include a functional training session on fire alarm control panel operation and instruction on peripheral device operation, including what are normal indications and alarm indications of each type of new/added device. Videotape all training sessions and deliver (4) copies of tapes to Owner (for use in future training).
- B. Instruct Owner on the importance of fixing any items not found functional during the testing. They must be made aware of the liability associated with failure to repair the system as expeditiously as possible. Failure to do so may result in the injury or death of numerous people in the unfortunate event of a fire.

3.19 FINAL DRAWINGS

- A. As-built drawings shall be given to the Owner's representative, at time of instruction, in addition to those to be supplied as general requirements of the job.

3.20 AUTHORITY HAVING JURISDICTION

- A. The drawings and specifications herein comply to the best of the engineer's knowledge with all applicable codes at time of design. However, coordinate/verify (prior to bid) the requirements of the authority having jurisdiction over this project and bring any discrepancies to the engineer's attention at least 7 days prior to bid. No changes in contract cost will be acceptable after the bid for work/equipment required to comply with the authority having jurisdiction

END OF SECTION 28 31 11

SECTION 32 3100
FENCES AND GATES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Galvanized-steel chain link fabric
 - 2. Privacy slats
 - 3. Fabric screen

1.2 SUBMITTALS

- A. Product Data: Manufacturer's technical data and specifications for fence and gate posts, fabric, gates, gate operators, and accessories.
- B. Shop Drawings: Show location of fence, gates, each post, and details of post installation, extension arms, gate swing, hardware, and accessories.
- C. Sample warranties

1.3 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an experienced Installer who has at least three years' experience and has completed at least five chain link fence projects with same material and of similar scope to that indicated for this Project with a successful construction record of in-service performance.
- B. Single-Source Responsibility: Obtain chain link fences and gates, including accessories, fittings, and fastenings, from a single source.

1.4 DELIVERY, STORAGE AND HANDLING

- A. Deliver chain link fencing fabric and all components to the Site in protected condition.
- B. Store undercover as directed by the chain link manufacturer.

1.5 PROJECT CONDITIONS

- A. Field Measurements: Verify layout information for fences and gates shown on the Drawings in relation to the property survey and existing structures. Verify dimensions by field measurements.
- B. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
 - 1. Notify Architect not less than 2 days in advance of proposed utility interruptions.
 - 2. Do not proceed with utility interruptions without Architect's written permission.

PART 2 - PRODUCTS

2.1 FABRIC

- A. Selvage: Knuckled on both selvages.

- B. Steel Chain-Link Fence Fabric: Fabricated in one-piece widths for fencing 12 feet and less in height to comply with Chain Link Fence Manufacturers Institute (CLFMI) "Product Manual" and with requirements indicated below:
1. Mesh and Wire Size: 2-inch mesh, 0.192-inch diameter (6 gage).

2.2 FRAMING

- A. Round member sizes are given in actual outside diameter (OD) to the nearest thousandth of inches. Round fence posts and rails are often referred to in ASTM standard specifications by nominal pipe sizes (NPS) or the equivalent trade sizes in inches. The following indicates these equivalents all measured in inches:

<u>Actual OD</u>	<u>NPS Size</u>	<u>Trade Size</u>
1.315	1	1-3/8
1.660	1-1/4	1-5/8
1.900	1-1/2	2
2.375	2	2-1/2
2.875	2-1/2	3
3.500	3	3-1/2
4.000	3-1/2	4
6.625	6	6-5/8
8.625	8	8-5/8

- B. Type I Round Posts: Standard weight (schedule 40) galvanized-steel pipe conforming to ASTM F 1083, according to heavy industrial requirements of ASTM F 669, Group IA, with minimum yield strength of 25,000 psi, not less than 1.8 oz. of zinc per sq. ft. Type A coating inside and outside according to ASTM F 1234, as determined by ASTM A 90, and weights per foot as follows:

<u>Actual OD</u>	<u>Weight (lb/ft)</u>	<u>NPS Size</u>
1.315	1.68	1
1.660	2.27	1-1/4
1.900	2.72	1-1/2
2.375	3.65	2
2.875	5.79	2-1/2
3.500	7.58	3
4.000	9.11	3-1/2
6.625	8.97	6
8.625	28.55	8

- C. Type II Round Posts: Cold-formed, electric-welded steel pipe conforming to heavy industrial requirements of ASTM F 669, Group IC, with minimum yield strength of 50,000 psi, either protective coating system below according to ASTM F 1234, and weights per foot as follows:

1. Coatings: Type B outside with a minimum of 0.9 oz. of zinc per sq. ft. after welding, a chromate conversion coating and a clear polymer overcoat. Type B inside with a minimum of 0.9 oz. of zinc per sq. ft. or Type D inside with a minimum 0.3-mil-thick, 81-percent zinc-pigmented nominal coating.
2. Coatings: Type C inside and outside with not less than 0.9 oz. of zinc-5 percent aluminum alloy per sq. ft.

<u>Actual OD</u>	<u>Weight (lb/ft)</u>	<u>NPS Size</u>
1.315	1.35	1
1.660	1.84	1-1/4

1.900	2.28	1-1/2
2.375	3.12	2
2.875	4.64	2-1/2
3.500	5.71	3
4.000	6.56	3-1/2

- D. Top Rail: Manufacturer's longest lengths (17 to 21 feet) with swaged-end or expansion-type coupling, approximately 6 inches long for joining. Provide rail ends or other means for attaching top rail securely to each gate corner, pull, and end post.
1. Round Steel: 1.660-inch OD Type I or II steel pipe.
- E. Steel posts for fabric heights up to 6 feet:
1. Round Line or Intermediate Posts: 1.90-inch OD Type I or II steel pipe.
 2. Round End, Corner, and Pull Posts: 2.375-inch OD Type I or II steel pipe.
- F. Steel posts for fabric heights over 6 feet:
1. Round Line or Intermediate Posts: 2.375-inch OD Type I or II steel pipe.
 2. Round End, Corner, and Pull Posts: 2.875-inch OD Type I or II steel pipe.
- G. Swing Gate Posts: Furnish posts to support single gate leaf, or one leaf of a double-gate installation, according to ASTM F 900, sized as follows for steel and aluminum pipe posts:
1. Steel posts for fabric height of 6 feet or less and gate leaf width:
 - a. Up to and Including 4 Feet: 2.375-inch OD pipe weighing at least 3.11 lb per ft.
 - b. Over 4 to 10 Feet: 2.875-inch OD pipe weighing at least 4.64 lb per ft.
 - c. Over 10 to 18 Feet: 4.000-inch OD pipe weighing at least 8.65 lb per ft.
 2. Steel posts for fabric height over 6 feet and gate leaf width:
 - a. Up to and Including 6 Feet: 2.875-inch OD pipe weighing at least 4.64 lb per ft.
 - b. Over 6 to 12 Feet: 4.000-inch OD pipe weighing at least 8.65 lb per ft.
 - c. Over 12 to 18 Feet: 6.625-inch OD pipe weighing at least 10.02 lb per ft.
 - d. Over 18 to 24 Feet: 8.625 OD pipe weighing at least 27.12 lb per ft.

2.3 FITTINGS AND ACCESSORIES

- A. Material: Comply with ASTM F 626. Galvanized iron or steel to suit manufacturer's standards.
1. Steel and Iron: Unless specified otherwise, hot-dip galvanize pressed steel or cast-iron fence fittings and accessories with at least 1.2 oz. zinc per sq. ft. as determined by ASTM A 90.
- B. Post and Line Caps: Provide weathertight closure cap for each post. Provide

line post caps with loop to receive tension wire or top rail.

- C. Post Brace Assembly: Manufacturer's standard adjustable brace. Use material specified below for brace, and truss to line posts with 3/8-inch-diameter rod and adjustable tightener. Provide manufacturer's standard galvanized-steel, cast-iron or cast-aluminum cap for each end.
 - 1. Round Steel: 1.660-inch OD Type I or II steel pipe.
- D. Bottom and Center Rail: Same material as top rail. Provide manufacturer's standard galvanized-steel, cast-iron or cast-aluminum cap for each end.
- E. Tension or Stretcher Bars: Hot-dip galvanized steel with a minimum length 2 inches less than the full height of fabric, a minimum cross section of 3/16 inch by 3/4 inch, and a minimum of 1.2 oz. of zinc coating per sq. ft. Provide one bar for each gate and end post, and two for each corner and pull post, except where fabric is integrally woven into the post.
- F. Tension and Brace Bands: 3/4-inch-wide minimum hot-dip galvanized steel with a minimum of 1.2 oz. of zinc coating per sq. ft.
 - 1. Tension Bands: 0.074 inch thick (14 gage) minimum.
 - 2. Brace Bands: 0.105 inch thick (12 gage) minimum.
- G. Tension Wire: 0.177-inch-diameter metallic-coated steel marcelled tension wire conforming to ASTM A 824 with finish to match fabric.
 - 1. Coating Type II zinc in the following class as determined by ASTM A 90.
 - a. Class 3, with a minimum coating weight of 2.00 oz. per sq. ft. of uncoated wire surface.
- H. Tension Wire: 0.192-inch-diameter (6-gage) mill-finished aluminum wires, ASTM B 211, alloy 6061-T94 with 50,000-psi minimum tensile strength.
- I. Tie Wires: 0.106-inch-diameter (12-gage) galvanized steel with a minimum of 0.80 oz. per sq. ft. of zinc coating according to ASTM A 641, Class 3 or 0.148-inch-diameter (9-gage) aluminum wire alloy 1350-H19 or equal, to match fabric wire.

2.4 PRIVACY SLATS

- A. Material: Polyvinyl chloride (PVC) light-stabilized, 0.023 inch thick minimum, sized to fit mesh specified in direction indicated.
- B. Color: Selected by Architect from manufacturer's standard colors.

2.5 CONCRETE

- A. Concrete: Provide concrete consisting of portland cement per ASTM C 150, aggregates per ASTM C 33, and potable water. Mix materials to obtain concrete with a minimum 28-day compressive strength of 3000 psi. Use at least four sacks of cement per cu. yd., 1-inch maximum size aggregate, 3-inch maximum slump.
- B. Packaged Concrete Mix: Mix dry-packaged normal-weight concrete conforming to ASTM C 387 with clean water to obtain a 2- to 3-inch slump.
- C. Refer to Division 03 Section, Cast-In-Place Concrete for additional requirements.

2.6 GATES

- A. Fabricate perimeter frames of gates from same material and finish as fence framework. Assemble gate frames by welding. Provide horizontal and vertical members to ensure proper gate operation and attachment of fabric, hardware, and accessories. Space frame members maximum of 8 feet apart unless otherwise indicated.
 - 1. Fabric: Same as for fence unless otherwise indicated. Secure fabric at vertical edges with tension bars and bands and to top and bottom of frame with tie wires.
 - 2. Bracing: Install diagonal cross-bracing consisting of 5/16-inch-diameter adjustable-length truss rods on gates to ensure frame rigidity without sag or twist.
- B. Swing Gates: Comply with ASTM F 900.
 - 1. Steel: Gates up to 8 feet wide:
 - a. Up to 6 Feet High: Fabricate perimeter frames of 1.660-inch minimum OD Type I or II steel pipe or 1-1/2-inch-square galvanized-steel tubing weighing 1.84 lb per sq. ft.
 - b. Over 6 Feet High: Fabricate perimeter frames of 1.90-inch minimum OD Type I or II steel pipe or 2-inch-square galvanized-steel tubing weighing 2.52 lb per sq. ft.
 - 2. Gate Hardware: Provide galvanized hardware and accessories for each gate according to the following:
 - a. Hinges: Size and material to suit gate size, non-lift-off type, offset to permit 180-degree gate opening. Provide 1-1/2 pair of hinges for each leaf over 6-foot nominal height.
 - b. Latch: Forked type or plunger-bar type to permit operation from either side of gate, with padlock eye as an integral part of latch.
 - c. Keeper: Provide a keeper for vehicle gates that automatically engages gate leaf and holds it in the open position until manually released.
 - d. Gate Stops: Provide gate stops for double gates consisting of mushroom-type flush plate with anchors, set in concrete, and designed to engage a center drop rod or plunger bar. Include a locking device and padlock eyes as an integral part of the latch, permitting both gate leaves to be locked with a single padlock.

2.7 WIND SCREEN

- A. Fabric for wind block at chain link fencing
- B. Materials
 - 1. 100% Polypropylene or vinyl coated polyester
 - 2. Weight: 7.7 ounces per square yard
 - 3. Shading: 90% with wind vents at 9-feet on center.
 - 4. Include brass grommets
 - 5. Lacing twine: Braded nylon

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install fence to comply with ASTM F 567. Do not begin installation and erection before final grading is completed, unless otherwise permitted.
 - 1. Apply fabric to outside of framework. Install fencing on boundary lines inside of property line established by survey.
- B. Excavation: Drill or hand-excavate (using post-hole digger) holes for posts to diameters and spacings indicated, in firm, undisturbed or compacted soil.
 - 1. If not indicated on Drawings, excavate holes for each post to minimum diameter recommended by fence manufacturer, but not less than four times the largest cross section of post.
 - 2. Unless otherwise indicated, excavate hole depths approximately 3 inches lower than post bottom, with bottom of posts set not less than 36 inches below finish grade surface.
- C. Setting Posts: Center and align posts in holes 3 inches above bottom of excavation. Space a maximum of 10 feet o.c., unless otherwise indicated.
 - 1. Protect portion of posts above ground from concrete splatter. Place concrete around posts and vibrate or tamp for consolidation. Check each post for vertical and top alignment, and hold in position during placement and finishing operations.
 - a. Unless otherwise indicated, extend concrete footings 2 inches above grade and trowel to a crown to shed water.
- D. Top Rails: Run rail continuously through line post caps, bending to radius for curved runs and at other posts terminating into rail end attached to posts or post caps fabricated to receive rail. Provide expansion couplings as recommended by fencing manufacturer.
- E. Center Rails: Install center rails in one piece between posts and flush with post on fabric side, using rail ends and special offset fittings where necessary.
- F. Brace Assemblies: Install braces at end and gate posts and at both sides of corner and pull posts. Locate horizontal braces at midheight of fabric on fences with top rail and at two thirds fabric height on fences without top rail. Install so posts are plumb when diagonal rod is under proper tension.
- G. Bottom Tension Wire: Install tension wire within 6 inches of bottom of fabric before stretching fabric and tie to each post with not less than same gage and type of wire. Pull wire taut, without sags. Fasten fabric to tension wire with 0.120-inch-diameter (11-gage) hog rings of same material and finish as fabric wire, spaced a maximum of 24 inches o.c.
- H. Top Tension Wire: Install tension wire through post cap loops before stretching fabric. Pull wire taut, without sags. Fasten fabric to tension wire with 0.120-inch-diameter (11-gage) hog rings of same material and finish as fabric wire, spaced a maximum of 24 inches o.c.
- I. Fabric: Leave approximately 2 inches between finish grade and bottom selvage unless otherwise indicated. Pull fabric taut and tie to posts, rails, and tension wires. Install fabric on security side of fence, and anchor to framework so that fabric remains under tension after pulling force is released.
- J. Tension or Stretcher Bars: Thread through fabric and secure to end, corner, pull, and gate posts with tension bands spaced not over 15 inches o.c.

- K. Tie Wires: Use wire of proper length to secure fabric firmly to posts and rails. Bend ends of wire to minimize hazard to persons or clothing.
 - 1. Maximum Spacing: Tie fabric to line posts 12 inches o.c. and to rails and braces 24 inches o.c.
- L. Fasteners: Install nuts for tension bands and carriage bolts on the side of the fence opposite the fabric side. Peen ends of bolts or score threads to prevent removal of nuts for added security.
- M. Privacy Slats: Install slats in direction indicated, securely locked in place.
 - 1. Vertically
 - 2. Horizontally
 - 3. Diagonally

3.2 GATE INSTALLATION

- A. Install gates plumb, level, and secure for full opening without interference. Install ground-set items in concrete for anchorage. Adjust hardware for smooth operation and lubricate where necessary. Install gates according to manufacturer's instructions, plumb, level, and secure.

3.3 ADJUSTING

- A. Gates and Gate Operators: After repeated operation of completed installation equivalent to 3 days' use by normal traffic, readjust gates and gate operators and controls for optimum operating condition and safety. Lubricate operating equipment and clean exposed surfaces.

3.4 DEMONSTRATION

- A. Instruct the Owner's personnel on proper operation and maintenance of gate operators.

END OF SECTION 32 3100