

**PROJECT MANUAL INCLUDING  
SPECIFICATIONS FOR CONSTRUCTION OF:  
  
THREE POINTS MAINTENANCE FACILITY**



**ORANGE COUNTY, FLORIDA**

**January 17, 2014**

**BID/PERMIT DOCUMENTS**

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**SECTION 01001 - PROJECT DIRECTORY**

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END SECTION - 01001

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## **SECTION 01005-ADMINISTRATIVE PROVISIONS**

### **PART I GENERAL**

#### **1.01 WORK COVERED BY CONTRACT DOCUMENTS**

- A. Work of this Contract comprises building, site work, dewatering operations, access road, road work, utilities, grading, paving, drainage, ditches, ponds, phase construction, demolition and related construction work to produce a complete and functional Three Points Maintenance Buildings & Site Complex including but not limited to office building, garage/storage building, cover canopy fuel island, storage building, emergency generator with enclosure, material storage bins, site work, underground utilities, paving, concrete, excavation, compacting, and landscaping/irrigation for the construction of the THREE POINTS MAINTENANCE FACILITY.

#### **1.02 CONTRACT METHOD**

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

#### **1.03 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, plumbing, systems 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 facility maintenance and for future 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 through floors, walls and ceilings, and fire safe where necessary as part of the lump sum price.

#### 1.04 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. “ARTICLE 7 - REFERENCE POINTS

Availability of Lands: The County will furnish, as indicated in the Contract Documents and not later than the date when needed by the Contractor, the lands upon which the Work is to be done, rights-of-way for access thereto and such other lands which are designated for the use of the Contractor. Easements for permanent structures or permanent changes in existing facilities will be obtained by the County unless otherwise specified in the Contract Documents. If the Contractor believes that any delay in the County's furnishing these lands or easements entitles him to an extension of the Contract Time, he may make a claim therefore as provided in Article 13. The Contractor will provide for all additional lands and access thereto that may be required for temporary construction facilities or storage of materials and equipment. The Project Manager will, upon request, furnish to the Contractor copies of all available boundary surveys and subsurface test.

Unforeseen Subsurface Conditions: The Contractor will promptly notify the Project Manager in writing of any subsurface or latent physical conditions at the site which may differ materially from those indicated in the Contract Documents. The Project Manager will promptly investigate those conditions and advise the Contractor in writing if further surveys or subsurface tests are necessary. Promptly thereafter, if needed, the Project Manager will obtain the necessary additional surveys and tests and furnish copies to the Contractor. If the Project Manager finds that the results of such surveys or tests indicate subsurface or latent physical conditions differing significantly from those indicated in the Contract Documents, a Change Order shall be issued incorporating the necessary revisions, in accordance with Article 12.

**Reference Points:** The Contractor shall be responsible for all field survey work coincidental with completion of this Work as specified herein. All survey work shall be done under the supervision of a Registered Professional Surveyor and Mapper. The County shall furnish, one time, a set of permanent reference markers along the line of work to form the basis for the above Contractor's survey.

All Section Corners and corners falling within the limits of this Work shall be perpetuated by a Florida Registered Surveyor and Mapper.

- A. All such corners falling within or on the boundaries of this project shall have reference ties made, certified to and submitted to the County Surveyor, Orange County, Florida, prior to the commencing of construction.
- B. Upon completion of construction and prior to Final Completion, certified corner records shall be submitted to the Department of Natural Resources in compliance with Florida Statutes, Chapter 177.507 and a copy of said certified corner record shall also be submitted to the Orange County Surveyor. Said corner records shall reflect the corner as perpetuated and which shall meet these minimum standards.
  - 1. If the corner falls in asphalt or concrete construction, the corner shall be a 2 1/4" metal disc marked according to standard government practices and set in concrete no less than 18" in depth and shall be encased in an adjustable 5 1/4" diameter or larger valve box raised to the finished surface of construction.
  - 2. If the corner falls at any other location, it shall be a 4" x 4" concrete monument no less than 23" long with a 2 1/4" metal disc marked according to standard government practices. The top of said monument shall be set flush with the ground ( $\pm 0.5'$  depending on conditions).
- C. Any U.S.C. and G.S. monument within limits of construction are to be protected. If monuments are in danger of damage, the Contractor shall contact the Project Manager and the Orange County Surveyor prior to the commencing of construction.
- D. Payment for all necessary survey work shall be included in the bid as part of other items of work."

#### 1.05 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 and if no date is specified, use the latest edition.
- C. 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. The description of the project is as follows: Office Building, garage/storage building, Covered Fuel Island, Material Bins, emergency generator with enclosure, storage building, road work, utilities, site work, drainage, ponds, paving and landscape/irrigation complete.

#### **1.03 WORK UNDER OTHER CONTRACTS**

- A. Separate contracts may be issued to perform certain construction operations at the site.

#### **1.04 BUILDING/SITE SECURITY**

- A. The site shall be secured by the General Contractor from unwarranted entry at the end of each day.
- B. The construction site 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.

#### **1.05 CONTRACTOR USE OF PREMISES**

- A. General: During the construction period the Contractor shall have full use of the premises for construction operations, including use of the site. The Contractors use of the premises is limited only by the Owners right to perform construction operations with the own forces or to employ separate contractors on portions of the project.
- B. General: Limit 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.
3. Burial of Waste Materials: Do not dispose of construction debris, vegetation and hazardous material on site, either by burial or by burning.

#### 1.06 DISTRIBUTION OF RELATED DOCUMENTS

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

#### 1.07 CONTRACT DOCUMENT FILE

- A. Copies of the Contract Documents, Plans, Specifications, Addenda, Change Orders, Architects Supplemental Instructions, approved Shop Drawings, Substitution Approvals, etc. shall be placed and maintained in the Contractors field office at the project site by the Contractor throughout the entire contract period. Said these documents shall be filed in a manner that allows for ease of retrieval. Documents shall be made available to the Architect/Engineer and the County's representatives throughout this same period.

### 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 in this section. 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 on 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 Contractors Applications for Payment.
- B. The Contractors 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 Contractors 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. Contractors 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.
  - f. Concrete broken down at least into foundation, slab on grade, columns, beams and suspended slabs.
  - g. Masonry divided into C.M.U. stem walls, exterior walls, interior walls.
  - h. Plumbing broken down at least into underslab rough-in, vents and stacks, supply piping, equipment items (each listed separately), fixtures and trim.
  - l. 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. Labor and material.
  - l. Logical grouping of specification subsections are 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 Owners 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. See items G, I, J and K of this section.
- 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 Countys 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 to the last day of the construction period covered by the application.
- E. Transmittal: Submit six (6) 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. Waivers of Mechanics Lien: With each Application for Payment submit waivers of mechanics liens from subcontractors of sub-subcontractors and suppliers for the construction period covered by the previous application.
1. Submit partial waivers on each item for the amount requested, prior to deduction for retainage, on each item.
  2. When an application shows completion of an item, submit final or full waivers.
  3. The Owner reserves the right to designate which entitles involved in the work must submit waivers.
  4. List all Subcontractor start and finish dates to substantiate any Notice to Owner received by the Project Manager.
- G. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of the first Application for Payment include the following:
1. List of principal subcontractors
  2. List of principal suppliers and fabricators
  3. Schedule of Values
  4. Approved Contractors Construction Schedule (preliminary if not final)
  5. Schedule of principal products
  6. Schedule of unit prices (if applicable)
  7. Submittal schedule (preliminary if not final)
  8. List of Contractors staff assignments
  9. List of Contractors principal consultants
  10. Copies of building permits for trades requiring separate permits
  11. Copies of authorizations and licenses from governing authorities for performance of the Work
  12. Initial progress report
  13. Report of Pre-Construction Meeting

14. Initial settlement survey and damage report, if required
  15. Listing of all long lead procurement items monthly applications for payment will be accompanied with updated schedule and review of as-built drawings.
- H. Interim Application for Payment: Payment will be processed once a month. No applications will be processed without receipt of previous months waiver of lien described in subsection F above. 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 interim applications.
- I. Applications 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.
- J. Administrative actions and submittals that shall proceed or coincide with Substantial Completion Payment. Substantial Completion as defined per General Conditions Section F application include:
1. Occupancy permits and similar approvals
  2. Warranties (guarantees) and maintenance agreements
  3. Test/adjust/balance records
  4. Maintenance instructions
  5. Start-up performance reports
  6. Change-over information related to Owners occupancy, use, operation and maintenance
  7. Final cleaning
  8. Application for reduction of retainage, and consent of surety
  9. List of incomplete Work, recognized as exceptions to Project Managers Certificate of Substantial Completion
- K. Final Payment Application: Administrative actions and submittals which must precede or coincide with submittal of the final payment Application for Payment include the following:
1. Completion of Project Close-out requirements
  2. Completion of items specified for completion after Substantial Completion
  3. Assurance that unsettled claims will be settled
  4. Assurance that all work has been completed and accepted
  5. Proof that taxes, fees and similar obligations have been paid
  6. Removal of temporary facilities and services
  7. Removal of surplus materials, rubbish and similar elements

8. Change of door locks to Owners access

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.
- B. Related Sections: The following sections contain requirements that relate to this section:
  - 1. Division 1 Section 01300 Submittals for requirements for the Contractors Construction Schedule.
  - 2. Division 1 Section 01027 Application for Payment for administrative procedures governing applications for payment.
  - 3. Division 1 Section 01631 Product Substitutions for administrative procedures for handling requests for substitutions made after award of the Contract.

#### **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 Owners 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 of 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 Representatives 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 A Product Substitutions if the proposed change in the Work requires the 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.

C. Proposal Request Form: Project Manager will transfer the information to

the appropriate forms for approval. Use AIA Document G 709 for Change Order Proposal Requests.

- D. Proposal Request Form: Use forms provided by the Owner for Change Order Proposals.

#### 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.

#### 1.06 CHANGE ORDER PROCEDURES

- A. Upon the Owners 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 Contractors Construction Schedule are included in Section 01300 Submittals.

#### **1.03 COORDINATION**

- A. Coordination: Coordinate construction activities included under various Sections of these Specifications to assure efficient and orderly installation of each part of the Work. Coordinate construction operations included under different Sections of the Specifications 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 if this and other sections of the contract documents 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 01300 Submittals.
  - 4. Refer to Division 15 Section Basic Mechanical Requirements, and

Division 16 Section Basic Electrical Requirements for specific coordination Drawing requirements for mechanical and electrical installations.

- B. Staff Names: At the Preconstruction Conference submit a list of the Contractors 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.

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION

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. Manufacturers 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 insure 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 01045 - CUTTING AND PATCHING**

### **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 cutting and patching.
- B. Refer to other Sections for specific requirements and limitations applicable to cutting and patching individual parts of the Work.
  - 1. Requirements of this Section apply to mechanical and electrical installations. Refer to Division 15 and Division 16 Sections for other requirements and limitations applicable to cutting and patching mechanical and electrical installations.

#### **1.03 SUBMITTALS**

- A. Cutting and Patching Proposal: Where approval of procedures for cutting and patching is required before proceeding, submit a proposal describing procedures well in advance of the time cutting and patching will be performed and request approval to proceed. Include the following information, as applicable, in the proposal:
  - 1. Describe the extent of cutting and patching required and how it is to be performed; indicate why it cannot be avoided.
  - 2. Describe anticipated results in terms of changes to existing construction; include changes to structural elements and operating components as well as changes in the buildings appearance and other significant visual elements.
  - 3. List products to be used and firms or entities that will perform Work.
  - 4. Indicate dates when cutting and patching is to be performed.
  - 5. List utilities that will be disturbed or affected, including those that will be relocated and those that will be temporarily out-of-service.

Indicate how long service will be disrupted.

6. Where cutting and patching involves addition of reinforcement to structural elements, submit details and engineering calculations to show how reinforcement is integrated with the original structure.
7. Approval by the Architect to proceed with cutting and patching does not waive the Architect's right to later require complete removal and replacement of a part of the Work found to be unsatisfactory.

#### 1.04 QUALITY ASSURANCE

- A. Requirements for Structural Work: Do not cut and patch structural elements in a manner that would reduce their load carrying capacity or load-deflection ratio.
  1. Obtain written approval of the cutting and patching proposal before cutting and patching the following structural elements.
    - a. Foundation construction
    - b. Bearing and retaining walls
    - c. Structural concrete
    - d. Structural steel
    - e. Lintels
    - f. Timber and primary wood framing
    - g. Structural decking
    - h. Miscellaneous structural metals
    - i. Stair systems
    - j. Exterior curtain wall construction
    - k. Equipment supports
    - l. Piping, ductwork, vessels and equipment
    - m. Structural systems of special construction in Division 13.
- B. Operational and Safety Limitations: Do not cut and patch operating elements or safety related components in a manner that would result in reducing their capacity to perform as intended, or result in increased maintenance, or decreased operational life or safety. Refer to Divisions 15 and 16 regarding Fire Rated Penetrations.
  1. Obtain approval of the cutting and patching proposal before cutting and patching the following operating elements or safety related systems.
    - a. Shoring, bracing and sheeting
    - b. Primary operational systems and equipment
    - c. Air or smoke barriers
    - d. Water, moisture, or vapor barriers
    - e. Membranes and flashings



- f. Fire protection systems
  - g. Noise and vibration control elements and systems
  - h. Control systems
  - l. Communication systems
  - j. Conveying systems
  - k. Electrical wiring systems
  - l. Special construction specified by Division 13 Sections
- C. Visual Requirements: Do not cut and patch construction exposed on the exterior or in occupied spaces, in a manner that would, in the Architects opinion, reduce the buildings aesthetic qualities, or result in visual evidence of cutting and patching. Remove and replace Work cut and patched in a visually unsatisfactory manner.
- 1. If possible retain the original installer or fabricator to cut and patch the following categories or exposed Work, or if it is not possible to engage the original installer or fabricator, engage another recognized experienced and specialized firm:
    - a. Processed concrete finishes
    - b. Preformed metal panels
    - c. Window wall system
    - d. Stucco and ornamental plaster
    - e. Acoustical ceilings
    - f. Carpeting
    - g. Wall covering
    - h. HVAC enclosures, cabinets or covers
    - l. Roofing systems

## PART 2 PRODUCTS

### 2.01 MATERIALS

- A. Use materials that are identical to existing materials. If identical materials are not available or cannot be used where exposed surfaces are involved, use materials that match existing adjacent surfaces to the fullest extent possible with regard to visual effect unless otherwise indicated by Architect/Owner. Use materials whose installed performance will equal or surpass that of existing materials.

## PART 3 EXECUTION

### 3.01 INSPECTION

- A. Before cutting existing surfaces, examine surfaces to be cut and patched and conditions under which cutting and patching is to be performed. Take

corrective action before proceeding, if unsafe or unsatisfactory conditions are encountered.

1. Before proceeding, meet at the site with all parties involved in cutting and patching, including mechanical and electrical trades. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

### 3.02 PREPARATION

- A. Temporary Support: Provide temporary support of Work to be cut.
- B. Protection: Protect existing construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of the Project that might be exposed during cutting and patching operations.
- C. Avoid interference with use of adjoining areas and interruption of free passage to adjoining areas.
- D. Take all precautions necessary to avoid cutting existing pipe, conduit or ductwork serving the building, but scheduled to be removed or relocated until provisions have been made to bypass them.

### 3.03 PERFORMANCE

- A. General: Employ skilled workmen to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time and complete without delay.
  1. Cut existing construction to provide for installation of other components or performance of other construction activities and the subsequent fitting and patching required to restore surfaces to their original condition.
- B. Cutting: Cut existing construction using methods least likely to damage elements to be retained or adjoining construction. Where possible review proposed procedures with the original, installer; comply with the original installers recommendations.
  1. In general, where cutting is required use hand or small power tools designed for sawing or grinding, not hammering and chopping. Cut holes and slots neatly to size required with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
  2. To avoid marring existing finished surfaces, cut or drill from the exposed or finished side into concealed surfaces.

3. Cut through concrete and masonry using a cutting machine such as a Carborundum saw or diamond core drill.
  4. Comply with requirements of applicable Sections of Division 2 where cutting and patching requires excavating and backfilling.
  5. By-pass utility services such as pipe or conduit, before cutting, where services are shown or required to be removed. Cap, valve or plug and seal the remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after by-passing and cutting.
- C. Patching: Patch with durable seams that are as invisible as possible. Comply with specified tolerances.
1. Where feasible, inspect and test patched areas to demonstrate integrity of the installation.
  2. Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.
  3. Where removal of walls or partitions extends one finished area into another, patch and repair floor and wall surfaces in the new space to provide an even surface of uniform color and appearance. Remove existing floor and wall coverings and replace with new materials if necessary to achieve uniform color and appearance.
    - a. Where patching occurs in a smooth painted surfaces, extend final coat over entire unbroken surfaces containing the patch, after the patched area has received primer and second coat.

### 3.04 CLEANING

- A. Thoroughly clean area and spaces where cutting and patching is performed or used as access. Remove completely paint, mortar, oils, putty and items of similar nature. Thoroughly clean piping, conduit and similar features before painting or other finishing is applied. Restore damaged materials to their original condition.

END OF SECTION 01045

## SECTION -01070 ABBREVIATIONS

### PART 1 GENERAL

#### A. General:

A	Area Square Feet; Ampere
AAMA	Architectural Minimum Manufacturer's Association
ABS	Acrylonitrile Butadiene Styrene
A.C.	Alternating Current; Air conditioning; Plywood Grade A & C
A.B.	Anchor Belt
A.C.I.	American Concrete Institute
Acous.	Acoustical
AD	Plywood, Grade A & D
A.D.	Area Drain
Adh.	Adhesive
Addit	Additional
Adj.	Adjustable
af	Audio-frequency
Aff	Above Finished Floor
Afg	Above Finished Grade
A.G.A.	American Gas Association
Agg.	Aggregate
A.H.	Ampere Hours
A hr.	Ampere-hour
A.H.U.	Air Handling Unit
A.I.A.	American Institute of Architects
A.I.C.	Alternating Interrupting Capacity
AIC	Ampere Interrupting Capacity
AISC	American Institute of Steel Construction
Allow.	Allowance
ALT.	Alternate
Alt.	Altitude
Alum.	Aluminum
a.m.	Ante Meridiem
Amp.	Ampere
Anc.	Anchor
Anod.	Anodized
ANSI	American National Standards Institute
A.P.	Access Panel
Appd.	Approved
Approx.	Approximately

Apt.	Apartment
Arch.	Architectural
Asb.	Asbestos
A.S.B.C.	American Standard Building Code
A.S.H.R.A.E.	American Society of Heating, Refrig. & AC Engineers
A.S.M.E.	American Society of Mechanical Engineers
A.S.T.M.	American Society for Testing and Materials
Attchmt.	Attachment
Auto.	Automatic
Avg.	Average
A.W.G.	American Wire Gauge
AWI	American Wood Institute
AWS	American Welding Society
Bbl.	Barrel
B.C.	Bare Copper
B.& B.	Grade B. and Better;Balled and Burlapped
B.& S.	Bell and Spigot
B.& W.	Black and White
b.c.c.	Body-centered Cubic
Bd	Board
BE	Bevel End
B.F.	Board Feet
BF.	Bottom Face
Bg. Cem	Bag of Cement
BHP	Boiler Horsepower, Brake Horsepower
B.I.	Black Iron
Bit. ;Bitum	Bituminous
Bk.	Backed
Bkrs.	Breakers
Bldg.	Building
Blk.	Block
Blkg.	Blocking
Bm.	Beam
B.M.	Benchmark
B.O.C.	Bottom of Curb
BOT.	Bottom
Boil.	Boilermaker
B.P.M.	Blows Per Minute
BR	Bedroom
Brg.	Bearing
Brhe.	Bricklayer Helper
Bric.	Bricklayer
Brk.	Brick
Brkt.	Bracket
Brng.	Bearing
Brs.	Brass

Brz.	Bronze
Bsmt.	Basement
Bsn.	Basin
Btr.	Better
BTU	British Thermal Unit
BTUH	BTU per hour
Btwn.	Between
B.U.R.	Built up Roofing
BX	Interlocked Armored Cable
c	Conductivity
C	Hundred; Centigrade
C.	Course
C/C	Center to Center
Cab.	Cabinet
Cair.	Air Tool Laborer
Calc.	Calculated
Cap.	Capacity
Carp.	Carpenter
C.B.	Circuit Breaker
C.BD.	Chalk Board
C.C.A.	Chromate Copper Arsenate
C.C.F.	Hundred Cubic Feet
cd	Candela
cd/sf	Candela per Square Feet
CD	Grade of Plywood Face & Back
CDX	Plywood, grade C & D, exterior glue
Cefi.	Cement Finisher
Cem.	Cement
Cer.	Ceramic
CF	Hundred Feet
C.F.	Cubic Feet
CFM	Cubic Feet per Minute
c.g.	Center of Gravity
CG	Corner Guard
CHW	Chilled Water
C.I.	Cast Iron
C.I.P.	Cast in Place
Circ.	Circuit
C.J.	Control Unit
C.L.	Carload Lot
Clab.	Common Laborer
Clec.	Clock Equipment Cabinet
C.L.F.	Hundred Linear Feet
CLF	Current Limiting Fuse
Clg.	Ceiling
Clkg.	Caulking
Clo.	Closed

CLP	Cross Linked Polyethylene
Clr.	Clear
cm	Centimeter
CMP	Corr. Metal Pipe
C.M.U.	Concrete Masonry Unit
Cntr.	Counter
C.O.	Cleanout
Col.	Column
Conn.	Connection
Cont.	Continuous
Cont.	Contractor
C.Opng.	Cased Opening
CO2	Carbon Dioxide
Comb.	Combination
Compr.	Compressor
Conc.	Continuous; Continued
Cond.	Conductor
Corr.	Corrugated
Cos	Cosine
Cot	Cotangent
Cov.	Cover
CPA	Control Point Adjustment
Cplg.	Coupling
C.P.M.	Critical Path Method
CPVC	Chlorinated Polyvinyl Chloride
C.Pr.	Hundred Pair
CRC	Cold Rolled Channel
Creos.	Creosote
Crpt.	Carpet & Linoleum Layer
CRT	Cathode Ray Tube
CS	Carbon Steel
Csc	Cosecant
C.S.F.	Hundred Square Feet
CSI	Construction Specifications Institute
C.T.	Current Transformer
CTS	Copper Tube Size
Cu	Cubic
Cu. Ft.	Cubic Foot
cw	Continuous Wave
C.W.	Cool White; Cold Water
C. Wall	Curtain Wall
Cwt.	100 Pounds
C.W.X.	Cool White Deluxe
C.Y.	Cubic Yard (27 cubic feet)
C.Y./Hr.	Cubic Yard per Hour
Cyl.	Cylinder
d	Penny (nail size)

D	Deep; Depth; Discharge
Dis; Disch	Discharge
Db.	Decibel
Dbl.	Double
DC	Direct Current
Demob.	Demobilization
d.f.u.	Drainage Fixture Units
D.H.	Double Hang
DHU	Domestic Hot Water
Diag.	Diagonal
Diam.	Diameter
Distrib.	Distribution
Dk.	Deck
D.L.	Deck Load
Do.	Ditto
Dp.	Depth
D.P.S.T.	Double Pole, Single Throw
Dr.	Driver
Drink.	Drinking
D.S.	Double Strength
D.S.A.	Double Strength A Grade
D.S.B.	Double Strength B Grade
Dty.	Duty
DWV	Drain Waste Vent
DX	Deluxe White, Direct Expansion
dyn	Dynbe
e	Eccentricity
E	Equipment only; East
Ea	Each
E.B.	Encased Burial
Econ.	Economy
EDP	Electronic Data Processing
E.D.R.	Equiv. Direct Radiation
Eq.	Equation
Elec.	Electrician; Electrical
Elev.	Elevator; Elevating
EMT	Electrical Metallic Conduit; Thin Wall Conduit
Eng.	Engine
EPDM	Ethylene Propylene Diene Monomer
Eqhv.	Equip. Oper., heavy
Eqlt.	Equip. Oper., light
Eqmd.	Equip. Oper., medium
Eqmm.	Equip. Oper., Master Mechanic
Equol.	Equip. Oper., Oilers
ERW	Electric Resistance Welded
Est.	Estimated



esu	Electrostatic Units
E.W.	Each Way
EWT	Entering Water Temperature
Excav.	Excavation
Exp.	Expansion, Exposure
Ext.	Exterior
Extru.	Extrusion
f.	Fiber Stress
F	Fahrenheit; Female; Fill
Fab.	Fabricated
F.B.C.	Florida Building Code
FBGS	Fiberglass
F.C.	Foot candles
f.c.c.	Face Centered Cubic
f'c	Compressive Stress in Concrete; Extreme Compressive Stress
F.E.	Front End
FRP	Fluorinated Ethylene Propylene (Teflon)
F.G.	Flat Grain
F.H.A.	Federal Housing Administration
Fig.	Figure
Fin	Finished
Fixt.	Fixture
Fl. Oz.	Fluid Ounces
Flr.	Floor
F.M.	Frequency Modulation; Factory Mutual
Fmg.	Framing
Fndtn.	Foundation
Fori.	Foreman; Inside
Fount.	Fountain
FPM	Feet Per Minute
Fr.	Frame
F.R.	Fire Rating
FRK	Foil Reinforced Kraft
FRP	Fiberglass Reinforced Plastic
FS	Forged Steel
FSC	Cast Body; Cast Switch Box
Ft.	Foot; Feet
Ftng.	Fitting
Ftg.	Footing
Ft.Lb.	Foot Pound
Furn.	Furniture
FVNR	Full Voltage Non-Reversing
FXM	Female by Male
Fy.	Minimum Yield Stress of Steel
g	Gram
G	Gauss

Ga.	Gauge
Gal.	Gallon
Gal./Min.	Gallon Per Minute
Galv.	Galvanized
Gen.	General
G.F.I.	Ground Fault Interrupter
Glaz.	Glazier
GPD	Gallons per Day
GPH	Gallons per Hour
GPM	Gallons per Minute
GR	Grade
Gran.	Granular
Grnd.	Ground
H	High; High Strength Bar Joist; Henry
H.C.	High Capacity
H.D.	Heavy Duty; High Density
H.D.O.	High Density Overlaid
Hdr.	Header
Hdwe.	Hardware
Help.	Helper Average
HEPA	High Efficiency Particular Air Filter
Hg.	Mercury
HIC	High Interrupting Capacity
H.O.	High Output
Horiz.	Horizontal
H.P.	Horsepower; High Pressure
H.P.F.	High Power Factor
Hr.	Hour
Hrs./Day	Hours per Day
HSC	High Short Circuit
Ht.	Height
Htg.	Heating
Htrs.	Heaters
HVAC	Heating, Ventilating & Air Conditioning
Hvy.	Heavy
HW	Hot Water
Hyd.;Hydr.	Hydraulic
Hz.	Hertz (cycles)
I.	Moment of Inertia
I.C.	Interrupting Capacity
ID	Inside Diameter
I.D.	Inside Dimension; Identification
I.F.	Inside Frosted
I.M.C.	Intermediate Metal Conduit
In.	Inch
Incan.	Incandescent
Incl.	Included; Including

Int.	Interior
Inst.	Installation
Insul.	Insulation
I.P.	Iron Pipe
I.P.S.	Iron Pipe Size
I.P.T.	Iron Pipe Threaded
I.W.	Indirect Waste
J	Joule
J.I.C.	Joint Industrial Council
K	Thousand; Thousand Pounds; Heavy Wall Copper Tubing
K.A.H.	Thousand Amp. Hours
KCMIL	Thousand Circular Mils
KD	Knock Down
K.D.A.T.	Kiln Dried After Treatment
Kg	Kilogram
kG	Kilogauss
kgf	Kilogram force
kHz	Kilohertz
Kip	1000 Pounds
KJ	Kiljoule
K.L.	Effective Length Factor
Km	Kilometer
K.L.F.	Kips per Linear Foot
K.S.F.	Kips per Square Feet
K.S.I.	Kips per Square Inch
K.V.	Kilovolt
K.V.A	Kilovolt Ampere
K.V.A.R.	Kilovolt (Reactance)
KW	Kilowatt
KWh	Kilowatt-hour
L	Labor only; Length; Long; Medium Wall Copper Tubing
La.	Labor
lat	Latitude
Lath.	Lather
Lav.	Lavatory
lb,;#	Pound
L.B.	Load Bearing; L Conduit Body
L. & E.	Labor & Equipment
lb./hr.	Pounds per Hour
lb./L.F.	Pounds Per Linear Foot
L.C.L.	Less than Carload Lot
Ld.	Load
LE	Lead Equivalent
L.F.	Linear Foot
Lg.	Long; Length; Large

L. & H.	Light and Heat
L.H.	Long Span high Strength Bar Joist
L.J.	Long Span Standard Strength Bar Joist
L.L.	Live Load
L.L.D.	Lamp Lumen Depreciation
lm	Lumen
lm/sf	Lumen per Square Feet
lm/W	Lumen per Wall
L.O.A.	Length Over All
log	Logarithm
L.P.	Liquified Petroleum; Low Pressure
L.P.F.	Low Power Factor
L.R.	Long Radius
L.S.	Lump Sum
Lt.	Light
Lt.Ga	Light Gauge
L.T.L.	Less than Truckload Lot
Lt. Wt.	Lightweight
L.V.	Low Voltage
M	Thousand; Material; Male; Light Wall Copper Tubing
m/hr; M.H.	Man Hour
mA	Milliampere
Mach	Machine
Mag. Str.	Magnetic Starter
Maint.	Maintenance
Marb.	Marble Setter
Mat. Mat'l	Material
Max	Maximum
MBF	Thousand Board Feet
MBH	Thousand BTU's per hr.
MC	Metal Clad Cable
M.C.F.	Thousand Cubic Feet
M.C.F.M.	Thousand Cubic Feet per Minute
M.C.M.	Thousand Circular Mils
M.C.P.	Motor Circuit Protector
MD	Medium Duty
M.D.O.	Medium Density Overlaid
Med.	Medium
MF	Thousand Feet
M.F.B.M.	Thousand Feet Board Measure
Mfg.	Manufacturing
Mfrs.	Manufacturers
mg	Milligram
MGD	Million Gallons per Day
MGPH	Thousand Gallons per Hour
MH:M.H.	Manhole; Metal Halide; Man-Hour

MHz	Megahertz
Mi.	Mile
MI	Malleable Iron; Mineral Insulated
mm	Millimeter
Mill.	Millwright
Min.;min.	Minimum; minute
Misc.	Miscellaneous
mi	Millimeter
M.L.F.	Thousand Linear Feet
Mo.	Month
Mobil.	Mobilization
Mog.	Mogul Base
MPH	Miles Per Hour
MPT	Male Pipe Thread
MRT	Mile Round Trip
ms	Millisecond
M.S.F.	Thousand Square Feet
Mstz.	Mosaic & Terrazzo Worker
M.S.Y.	Thousand Square Yards
Mtd.	Mounted
Mthe.	Mosaic & Terrazzo Helper
Mult.	Multi; Multiply
M.V.A.	Million Volt Amperes
M.V.A.R.	Million Volt Amperes Reactance
MV	Megavolt
MW	Megawatt
MXM	Male by Male
MYD	Thousand Yards
N	Natural; North
nA	Nanoampere
NA	Not Available; Not applicable
N.B.C.	National Building Code
NC	Normally Closed
N.F.M.A.	National Electrical Manufacturers Association
NEHB	Bolted Circuit Breaker to 600V
N.L.B.	Non-Load-Bearing
NM	Non-Metallic Cable
nm	Nanometer
No.	Number
N.O.C.	Not Otherwise Classified
Nose.	Nosing
N.P.T.	National Pipe Thread
NQOB	Bolted Circuit Breaker to 240V
N.R.C.	Noise Reduction Coefficient
N.R.S.	Non Rising Stem
ns	Nanosecond

nW	Nanowatt
OB	Opposing Blade
OC	On Center
OD	Outside Diameter
O.D.	Outside Dimension
ODS	Overhead Distribution System
O & P	Overhead and Profits
Oper.	Operator
Opng.	Opening
Orna.	Ornamental
O.S. & Y.	Outside Screw and Yoke
Ovhd.	Overhead
OWG	Oil, Water or Gas
Oz.	Ounce
P.	Pole; Applied Load; Projection
p.	Page
Pape.	Paperhanger
P.A.P.R.	Powered Air Purifying Respirator
PAR	Weatherproof Reflector
Pc.	Piece
P.C.	Portland Cement; Power Connector
P.C.M.	Phase Contract Microscopy
P.C.F.	Pounds Per Cubic Feet
P.E.	Professional Engineer; Porcelain Enamel; Polyethylene; Plain End
Perf.	Perforated
Ph.	Phase
P.I.	Pressure Injected
Pile.	Pile Driver
pkg.	Package
Pl.	Plate
Plah.	Plaster Helper
Plas.	Plasterer
Pluh.	Plumbers Helper
Plum.	Plumber
Ply.	Plywood
p.m.	Post Meridiem
Pord.	Painter Ordinary
pp	Pages
PP;PPL	Polypropylene
P.P.M.	Parts per Million
Pr.	Pair
Prefab.	Prefabricated
Prefin.	Prefinished
Prop.	Propelled
PSF;psf	Pounds per Square Foot
PSI;psi	Pounds per Square Inch

PSIG	Pounds per Square Inch Gauge
PSP	Plastic Sever Pipe
Pspr.	Painter, Spray
Psst.	Painter, Structural Steel
P.T.	Potential Transformer
P. & T.	Pressure & Temperature
Ptd.	Painted
Ptns.	Partitions
Pu	Ultimate Load
PVC	Polyvinyl Chloride
Pvmt.	Pavement
Pwr.	Power
Q	Quantity Heat Flow
Quan.; Qty	Quantity
Q.C.	Quick Coupling
r	Radius of Gyration
R	Resistance
R.C.P.	Reinforced Concrete Pipe
Rect.	Rectangle
Reinf.	Reinforced
Req'd	Required
Res.	Resistant
Resi	Residential
Rgh.	Rough
R.H.W.	Rubber, Heat & Water Resistant; Residential Hot Water
rms	Root Mean Square
Rnd.	Round
Rodm.	Rodman
Rofc.	Roofer, Composition
Rofp.	Roofer, Prcast
Rohe.	Roofer Helpers (Composition)
Rots.	Roofer, Tile & Sale
R.O.W.	Right of Way
RPM	Revolutions per Minute
R.R.	Direct Burial Feeder Conduit
R.S.	Rapid Start
R.T.	Round Trip
S.	Suction; Single Entrance; South
Scaf.	Scaffold
Sch.;Sched.	Schedule
S.C.R.	Modular Brick
S.D.	Sound Deadening
S.D.R.	Standard Dimension Ratio
S.E.	Surfaced Edge
Sel.	Select
S.E.R.;S.E.U.	Service Entrance Cable

SF.	Square Foot	
S.F.C.A.	Square Foot Contact Area	
S.F.F.C.M.U.	Split Face Fluted Concrete Masonry Unit.	
S.F.G.	Square Foot of Ground	
S.F. Hor.	Square Foot Horizontal	
S.R.F.	Square Foot of Radiation	
S.F.Shlf.	Square Foot of Shelf	
S4S	Surface 4 Sides	
Shee.	Sheet Metal Worker	
Sin.	Sine	
Skwk.	Skilled Worker	
S.L.	Saran Lined	
S.L.	Slimline	
Sldr.	Solder	
S.N.	Solid Neutral	
S.P.	Static Pressure; Single Pole; Self	Propelled
Spri.	Sprinkler Installer	
Sq.	Square; 100 Square Feet	
S.P.D.T.	Single Pole, Double Throw	
S.P.S.T.	Single Pole, Single Throw	
SPT	Standard Pipe Thread	
Sq.Hd.	Square Head	
Sq.In.	Square Inch	
S.S.	Single Strength; Stainless Steel	
S.S.B.	Single Strength B Grade	
Sswk.	Structural Steel Worker	
Sswl.	Structural Steel Welder	
St.;Stl.	Steel	
S.T.C.	Sound Transmission Coefficient	
Std.	Standard	
STP	Standard Temperature & Pressure	
Stpi.	Steamfitter, Pipefitter	
Str.	Strength; Starter; Straight	
Strd.	Stranded	
Struct.	Structural	
Sty.	Story	
Subj.	Subject	
Subs.	Subcontractors	
Surf.	Surface	
Sw.	Switch	
Swbd.	Switchboard	
S.Y.	Square Yard	
Syn.	Synthetic	
Sys.	System	
t.	Thickness	
T	Temperature; Ton	
Tan	Tangent	



T.C.	Terra Cotta
T & C	Threaded and Coupled
T.D.	Temperature Difference
T.E.M.	Transmission Electron Microscopy
TFE	Tetrafluoroethylene (teflon)
T.& G.	Tongue & Groove; Tar & Gravel
Th.;Thk.	Thick
Thn.	Thin
Thrded.	Threaded
Tilf.	Tile Layer Floor
Tilh.	Tile Layer Helper
THW	Insulated Strand Wire
THWN;THHN	Nylon Jacketed Wire
T.L.	Truckload
Tot.	Total
T.S.	Trigger Start
Tr.	Trade
Transf.	Transformer
Trhv.	Truck Driver, Heavy
Trir.	Trailer
Trit.	Truck Driver, Light
TV	Television
T.W.	Thermoplastic Water Resistant Wire
UCI	Uniform Construction Index
UF	Underground Feeder
U.H.F.	Ultra High Frequency
U.L.	Underwriters Laboratory
Unfin.	Unfinished
URD	Underground Residential Distribution
V	Volt
V.A.	Volt Amperes
V.C.T.	Vinyl Composition Tile
VAV	Variable Air Volume
VC	Veneer Core
Vent.	Ventilating
Vert.	Vertical
V.F.	Vinyl Faced
V.G.	Vertical Grain
V.H.F.	Very High Frequency
VHO	Very High Output
Vib.	Vibrating
V.L.F.	Vertical Linear Foot
Vol.	Volume
W	Wire; Watt; Wide; West
w/	With
W.C.	Water Column; Water Closet
W.F.	Wide Flange

W.G.	Water Gauge
Wldg.	Welding
W. Mile	Wire Mile
W.R.	Water Resistant
Wrck.	Wrecker
W.S.P.	Water Steam, Petroleum
WT, Wt.	Weight
WWF	Welded Wire Fabric
XRMR	Transformer
XHD	Extra Heavy Duty
XHHW;XLPE	Cross Linked Polyethylene Wire Insulation
Y	Wye
yd	Yard
yr	Year
Δ	Delta
%	Percent
Φ	Phase
@	At
<	Less Than
>	Greater Than

PART 2- PRODUCTS:

Not used.

PART 3- EXECUTION:

Not used.

END SECTION 01070

## **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, approved, required, and permitted mean directed by the Project Manager, requested by the Architect/Project Manager and similar phrases.
- D. Accepted: This term; Accepted, where used in conjunction with the Architects action on the Contractors submittals, applications, and requests, is limited to the Architects 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: testing laboratory is an independent entity engaged to perform specific inspections or tests, either at the Project site or elsewhere, and to report on and, if required, to interpret results of those inspections or tests.

### 1.03 SPECIFICATION FORMAT AND CONTENT EXPLANATION

- A. Specification Format: These Specifications are organized into Divisions and Sections based on the Construction Specifications Institutes 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.

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 Section 1300 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. Attends: The OWNERS, Representative, 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. Manufacturers 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 and agreements and disagreements of each conference along with and 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 PROGRESS MEETINGS

- A. Conduct progress meetings at the Project site at weekly 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 or involved in planning, coordination or performance of future activities with the Project and authorized to conclude matters relation 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. Contractors Construction Schedule: Review progress since the last meeting. Determine where each activity is in relation to the Contractors Construction Schedule, whether on time or 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. Contractors 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 Application for Payment.
- D. Inspection and test reports are included in Section 01410 "Testing Laboratory Services".

#### **1.03 SUBMITTAL PROCEDURES**

- A. 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. Submittal Preparation: Place a permanent label or title block on each submittal for identification. Indicate the name of the entity that prepared each submittal on the label or title block.
1. Provide a space approximately 4" x 5" on the label or beside the title block on Shop Drawings to record the Contractors review and approval markings and the action taken.
  2. Include the following information on the label for processing and recording action taken.
    - a. Project name
    - b. Date
    - c. Name and address of architect
    - d. Name and address of contractor

- e. Name and address of subcontractor
  - f. Name and address of supplier
  - g. Name of manufacturer
  - h. Number and title of appropriate Specification Section
  - i. Drawing number and detail references, as appropriate.
- C. Submittal Transmittal: Package each submittal appropriately for transmittal and handling. Transmit each submittal from Contractor to Project Manager using transmittal form as provided by the Project Manager. Submittals received from sources other than the Contractor will be returned without action.
- 1. On the transmittal Record relevant information and requests for data. On the form, or separate sheet, record deviations from Contract Document requirements, including minor variations and limitations. Include Contractors certification that information complies with Contract Document requirements.
  - 2. Transmittal Form: As provide by the Project Manager
- D. Contractor shall be responsible for cost of re-review of rejected submittals, shop drawing, etc. 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 consultants standard billing rates, plus 10% handling by the County.
- E. Substitution request to specified products will be made within 45 days of Notice to Proceed. After the 45 day period, no requests for substitution from the Contractor will be considered.
- 1. Substitution submitted within the first 45 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. The Contractor shall include in their bid the cost of using the the specified listed products or those approved by pre-bid addenda. The county will not guarantee it will approve any request for substitution.

#### 1.04 CONTRACTORS CONSTRUCTION SCHEDULE

- A. Critical Path Method (CPM) Schedule: Prepare a fully developed, horizontal bar-chart type Contractors construction schedule. Submit in accordance with Section 01200 project Meetings.
- 1. Provide a separate time bar for each significant construction

- activity. Provide a continuous vertical line to identify the first working day of each week. Use the same breakdown of units of the Work as indicated in the Schedule of Values.
2. Within each time bar indicate estimated completion percentage in 10 percent increments. As Work progresses, place a contrasting mark in each bar to indicate Actual Completion.
  3. Prepare the schedule on a sheet, or series of sheets, of stable transparency, or other reproducible media, of sufficient width to show data for the entire construction period.
  4. Secure time commitments for performing critical elements of the Work from parties involved. Coordinate each element on the schedule with other construction activities; include minor elements involved in the sequence of the Work. Show each activity in proper sequence. Indicate graphically sequences necessary for completion of related portions of the Work.
  5. Coordinate the Contractors construction schedule with the schedule of values, list of subcontracts, submittal schedule, progress reports, payment request and other schedules.
  6. Indicate completion in advance of the date established for Substantial Completion. Indicate Substantial Completion on the schedule to allow time for the Architects procedures necessary for certification of Substantial Completion.
- B. Phasing: Provide notations on the schedule to show how the sequence of the Work is affected by requirements for phased completion to permit Work by separate contractors and partial occupancy by the Owner prior to Substantial Completion.
- C. Work Stages: Indicate important stages of construction for each major portion of the Work, including testing and installation.
- D. Area Separations: Provide a separate time bar to identify each major construction area for each major portion of the Work. Indicate where each element in an area must be sequenced or integrated with other activities.
- E. Cost Correlation: At the head of the schedule, provide a two item cost correlation line, indicating pre-calculated and actual costs. On the line show dollar-volume of Work performed as the dates used for preparation of payment requests.

1. Refer to Section Applications for Payment for cost reporting and payment procedures.
- F. Distribution: Following response to the initial submittal, print and distribute copies to the Architect, Owner, subcontractors, and other parties required to comply with schedule dates. Post copies in the Project meeting room and temporary field office.
1. When revisions 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.
- G. Schedule Updating: Revise the schedule monthly or activity, where revisions have been recognized or made. Issue the updated schedule concurrently monthly pay request.

#### 1.05 SUBMITTAL LOG

- A. After development and acceptance of the Contractors 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 Contractors 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 Architects 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 revisions are made, distribute to the same parties and post at 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 completion, occupancies
  14. Substantial Completion 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 Drawing 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" 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 Managers review; the reproducible print will be returned.
8. Initial Submittal: Submit 2 blue-or black-line prints for the Architects review; one will be returned.
9. Final Submittal: Submit 2 blue-or black-line prints; submit 2 prints where required for maintenance manuals. 2 prints will be retained; the remainder will be returned.
10. Final Submittal: Submit 3 blue-or black-line prints; submit 2 prints where required for maintenance manuals. 2 prints will be retained; the remainder will be returned.
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. Submit coordination Drawings for integration of different construction elements. Show sequence and relationships of separate components to avoid any conflict including conflicts in use of space.
3. 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 manufacturers 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 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. Manufacturers 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 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 Installers 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 Architects/Owners 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 Architects/Owners 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.

#### 1.10 ARCHITECTS 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 Contractors responsibility.
- B. Action Stamp: The Architect/Project Manager 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: Where submittals are marked No Exceptions Taken, that part of the Work covered by the submittal may proceed provided it complies with requirements of the Contract Documents; final acceptance will depend upon that compliance.
  2. Final-But-Restricted Release: When submittals are marked Make Corrections Noted that part of the Work covered by the submittal may proceed provided it complies with notations or corrections on the submittal and requirements of the Contract Documents; final acceptance will depend on that compliance.
  3. Returned for Resubmittal: When submittal is marked Revise and Resubmit, do not proceed with that part of the Work covered by the submittal, including purchasing, fabrication, delivery, or other activity. Revise or prepare a new submittal in accordance with the notations; resubmit without delay. Repeat if necessary to obtain a different action mark.
    - 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.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

PART 4 - SCHEDULE

4.1 SCHEDULE OF SUBMITTALS DESCRIPTION (SD) AND SUBMITTAL REGISTER

- A. General: The following is a description of each submittal type, specified in other Sections, required for the Project. Include each submittal description (SD) in the Submittal Register included as part of this Section.
1. SD-01: Product Data; submittals which provide calculations, descriptions or other documentation regarding the work.
  2. SD-02: Manufacturer's Catalog Data (Product Data); data composed of information sheets, brochures, circulars, specifications and product data, and printed information in sufficient detail and scope to verify compliance with requirements of the Contract Documents.
  3. SD-03: Manufacturer's Standard Color Charts (Product Data); preprinted illustrations displaying choices of color and finish for a material or product. A type of product data.
  4. SD-04: Shop Drawings; graphic representations which illustrate relationship of various components of the work, schematic diagrams of systems, details of fabrications, layout of particular elements, connections, and other relational aspects of the work.
  5. SD-05: Design Data (Shop Drawings); design calculations, mix designs, analyses, or other data written and pertaining to a part of the work.
  6. SD-06: Instructions (Product Data); preprinted material describing installation of a product, system, or material, including special notices and Material Safety Data Sheets, if any, concerning impedance, hazards, and safety precautions.
  7. SD-07: Schedules (Shop Drawings); a tabular list of data or a tabular listing of locations, features, or other pertinent information regarding products, materials, equipment, or components to be used in the work.

8. SD-08: Statements (Shop Drawings); a document, required of the Contractor, or through the Contractor by way of a supplier, installer, manufacturer, or other lower tier contractor, the purpose of which is to further the quality or orderly progression of a portion of the work by documenting procedures, acceptability of methods or personnel, qualifications, or other verification of quality.
9. SD-09: Reports (Product Data); reports of inspection and laboratory tests, including analysis, an interpretation of test results. Each report shall be properly identified. Test methods used and compliance with recognized test standards shall be described.
10. SD-10: Test Reports (Product Data); a report signed by an authorized official of a testing laboratory that a material, product, or system identical to the material, product or system to be provided has been tested in accordance with requirements specified by naming the test method and material. The test report must state the test was performed in accordance with the test requirements; state the test results; and indicate whether the material, product, or system has passed or failed the test. Testing must have been within three years of the date of award of this Contract.
11. SD-11: Factory Test Reports (Shop Drawings); a written report which includes the findings of a test required to be performed by the Contractor or an actual portion of the work or prototype prepared for this project before it is shipped to the job site. The report must be signed by an authorized official of a testing laboratory and must state the test was performed in accordance with the test requirements; state the test results; and indicate whether the material, product, or system has passed or failed the test.
12. SD-12: Field Test Reports (Shop Drawings); a written report which includes the findings of a test made at the job site, in the vicinity of the job site, or on a sample taken from the job site, on a portion of the work, during or after installation. The report must be signed by an authorized official of a testing laboratory or agency and must state the test was performed in accordance with the test requirements; state the test results; and indicate whether the material, product, or system has passed or failed the test.
13. SD-13: Certificates (Shop Drawings); statements signed by responsible officials of a manufacturer of a product, system, or material attesting that the product, system, or material meet specified requirements. The statements must be dated after the award of this contract, name the project, and list the specific requirements which it is intended to address.

14. SD-14: Warranties (Product Data); statements signed by responsible officials of a manufacturer of a product, system, or material attesting that the product, system, or material will perform its specific function over a specified duration of time. The statement must be dated, and include the name of the project, the Owner's name, and other pertinent data relating to the warranty.
15. SD-15: Samples; samples, including both fabricated and non-fabricated physical examples of materials, products, and units of work as complete units or as portions of units of work.
16. SD-16: Color Selection Samples (Samples); samples of the available choice of colors, textures, and finishes of a product or material, presented over substrates identical in texture to that proposed for the work.
17. SD-17: Sample Panels (Samples); an assembly constructed at the project site in a location acceptable to the Owner's Representative and using materials and methods to be employed in the work; completely finished; maintained during construction; and removed at the conclusion of the work or when authorized by the Owner's Authorized Representative.
18. SD-18: Sample Installations (Samples); a portion of an assembly or material constructed where directed and, if approved, retained as a part of the work.
19. SD-19: Records; documentation to ensure compliance with an administrative requirement or to establish an administrative mechanism.
20. SD-20: Operation and Maintenance Manuals (Records); data intended to be incorporated in an Operations and Maintenance Manual
21. SD-21: Test Reports of Existing Conditions; a document describing existing conditions and operations of systems and components prior to the start of any work. Testing shall be held in the presence of the Owner's Authorized Representative. Provide copies of the test reports to the Owner's Authorized Representative.
22. SD-22: Demonstrations; physical operation of equipment and systems by factory authorized representatives to demonstrate to the Owner's facility personnel proper operation of systems. Provide all required documentation that certified completed demonstration.
23. SD-23: Record Drawings; delineated documentation accurately depicting final installation location of components and systems of the

building.

24. SD-24: Shop Drawings in Magnetic Medium; when drawings are required. All materials shall be provided in AUTOCAD Release 2000 or 2002.
- B. Submittal Register: The Contractor is to maintain an accurate updated submittal register and will bring this register to each scheduled progress meeting with the Owner and the Designer. This register should include the following items:
1. Submittal-Description and Number assigned.
  2. Date to Designer.
  3. Date returned to Contractor (from Designer).
  4. Status of Submittal (Accepted/Resubmit/Rejected).
  5. Date of Resubmittal and Return (as applicable).
  6. Date material released (for fabrication).
  7. Projected date of fabrication.
  8. Projected date of delivery to site.
  9. Status of submittal.

SUBMITTAL REGISTER (PART A)

Contract Number:                      Project

Title:

Spec. Section Number	Submittal Description (SD) Number	Spec. Paragraph Number	Designer Reviewer	Trans Control Number	Planned Submittal Date
(A)	(B)	(C)	(D)	(E)	(F)
02200	SD-12	1.4 A			
02270	SD-02, SD-15	1.3			
02281	SD-01	1.04			
02480	SD-12, SD-07, SD-13				
02513	SD-13	1.3 A			
02520	SD-01, SD-13	1.4A			
02577	SD-01, SD-02	1.3			
02666	SD-01, SD-23, SD-20	1.4A,B,C,D			
02668	SD-01, SD-04, SD-04, SD-23	1.4			
02720	SD-01, SD-20, SD-23	1.4A,B,C,D			
02730	SD-01, SD-20, SD-23	1.4A,B,C,D			
02800	SD-12, SD-20	1.7			
02831	SD-01	1.4A			
02900	SD-02,SD-04,SD-23	1.7			
03200	SD-01, SD-04	1.4			
03300	SD-05	1.4			
04200	SD-01, SD-13, SD-15	1.4			
05120	SD-04	1.5			
05220	SD-01, SD-04, SD-05	1.3			
05300	SD-01, SD-04, SD-05, SD-07	1.4			
05500	SD-04, SD-07, SD-13	1.4			
06100	SD-01, SD-13	1.3			
06400	SD-01, SD-04, SD-17	1.4			
06601	SD-02, SD-04, SD-16	1.2			
07193	SD-01, SD-02	1.3			
07200	SD-01, SD-02	1.4			
07270	SD-01, SD-04, SD-06, SD-07, SD-10, SD-13	1.4			
07613	SD-02, SD-04,	1.5			
07620	SD-01, SD-04, SD-15	1.4			
07622	SD-01, SD-04, SD-12, SD-13, SD14, SD-15, SD-15, SD-17	1.3			
07920	SD-01, SD-07, SD-17	1.4			



08100	SD-01, SD-04, SD-07	1.5			
08300	SD-01, SD-04	1.4			
08305	SD-01, SD-04	1.8			
08410	SD-01,SD-04, SD-13, SD-15	1.4			
08700	SD-01, SD-07	1.6			
08800	SD-01, SD-04, SD-13, SD-SD-15	1.5			
09220	SD-01	1.4			
09250	SD-01	1.4			
09320	SD-01, SD-16	1.4			
09510	SD-01, SD-17	1.2			
09660	SD01, SD-16, SD-06	1.4			
09900	SDD-01, SD-07, SD-16	1.3			
10200	SD-01, SD-07, SD-06, SD-03	1.5			
10350	SD-01, SD-04, SD-13	1.3			
10420	SD-01, SD-04	1.5			
10520	SD-01, SD-04	1.2			
10530	SD-02, SD-04, SD-06,SD-13,SD-15	1.3			
10670	SD-01, SD-04, SD-16	1.4			
10800	SD-01 - SD-07	1.3			
11450	SD-01	1.4			
12510	SD-01, SD-15, SD-16	1.3			
13120	SD-01, SD-04, SD-13	1.4			
15010	SD-02 Product Data	1.3.I			
15010	SD-06 Manufacturer Instructions	1.3.K			
15010	SD-20 O+M Instructions	1.3.Q			
15010	SD-22 Demonstrations	1.3.R			
15050	SD-04 Shop Drawings	1.5.B			
15050	SD-02 Product Data	1.5.C			
15051	SD-08 T + B Procedures	1.4.B			
15051	SD-07 T + B Test Data	1.4.C			
15051	SD-02 Refrigeration Cooling Perf. Data	3.5.C			
15051	SD-02 Heating Perf. Data	3.5.E			
15051	SD-07 T + B Test Data	3.7.A			
15055	SD-02 Product Data SD-02	1.5.B			
15060	SD-02 Materials List SD-02	1.6.B			
15060	SD-01 Refrigerant Piping Requirements	1.6.C			
15060	SD-08 Welding Qualif.	1.6.D			
15060	SD-12 Welding Insp. Reports	1.6.E			
15080	SD-02 Product Schedule	1.3.A			
15080	SD-20 O+M Instructions	1.3.B			
15090	SD-07 Product Schedule	1.5.A			
15090	SD-20 O+M Instructions	1.5.B			
15100	SD-02 Product Data	1.4.A			

15100	SD-20 O+M Instructions	1.4.B			
15133	SD-20 O+M Instructions	1.5.B			
15250	SD-07 Insulation Schedule	1.4.A			
15250	SD-02 Product Data	1.4.B			
15421	SD-02 Product Data	1.3.A			
15424	SD-02 Product Data	1.5.B			
15450	SD-02 Product Data	1.3.A			
15480	SD-02 Product Data	1.6.A			
15500	SD-04 Shop Drawings	1.4.C			
15772	SD-04 Shop Drawings	1.4.A			
15772	SD-02 Product Data	1.4.B			
15820	SD-02 Product Data	1.4.A			
15820	SD-20 O+M Instructions	1.4.B			
15840	SD-20 O+M Instructions	1.4.B			
15840	SD-04 Shop Drawings Ductwork	1.5.A			
15840	SD-04 Shop Drawings and Supports	1.5.B			
15846	SD-02 Product Data	1.4.A			
15846	SD-20 O+M Instructions	1.4.B			
15846	SD-04 Shop Drawings Ductwork	1.5.A			
15860	SD-02 Product Data	1.4.A			
15860	SD-20 O+M Instructions	1.4.B			
15880	SD-20 O+M Instructions	1.4.B			
16010	SD-23	1.16			
16010	SD-14	1.18			
16090	SD-12	3.1			
16095	SD-22	1.1			
16098	SD-20	1.2			
16111	SD-02	1.4			
16123	SD-02	1.3			
16131	SD-02	1.3			
16133	SD-01, SD-02	1.3			
16133	SD-23	1.4			
16141	SD-02, SD-06	1.3			
16160	SD-01, SD-02, SD-06	1.3			
16170	SD-23	1.3			
16170	SD-12	3.14			
16180	SD-02	1.4			
16421	SD-04	1.5			
16441	SD-02	1.4			
16471	SD-01, SD-02, SD-04	1.3			
16472	SD-01, SD-02, SD-04	1.3			
16510	SD-02	1.4			
16530	SD-02	1.4			
16671	SD-01, 2, 4 & 6	1.4			

Spec. Section Number	Submittal Description (SD) Number	Spec. Paragraph Number	Designer Reviewer	Trans Control Number	Planned Submittal Date
(A)	(B)	(C)	(D)	(E)	(F)
16671	SD-12	3.4			
16691	SD-01, SD-02	1.3			
16691	SD-14	1.8			
16723	SD-01, 2, 4, 6	1.7			
16723	SD-23	1.8			
16723	SD-20	1.9			
16723	SD-14	1.10			
16723	SD-22	1.13			
16723	SD-12	3.14			
16723	SD-13	3.15			



## **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 RELATED SECTIONS**

- A. Information Available to Bidders: Soil Investigation Data.
- B. General Conditions: Inspections, testing, and approvals required by public authorities.
- C. Individual Specification Sections: Inspections and tests required, and standards for testing.

#### **1.03 REFERENCES**

- A. ANSI/ASTM D3740 or as required in Specifications Divisions 2-16 - 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 or as required in Specifications Divisions 2-16 - Recommended Practice for Inspection and Testing Agencies for Concrete, Steel, and Bituminous Materials as Used in Construction.

#### **1.04 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.

#### 1.05 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.

#### 1.06 CONTRACTOR SUBMITTALS

NOT USED

#### 1.07 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.

#### 1.08 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.

#### 1.09 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.

#### 1.10 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 48 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.

#### 1.11 SCHEDULE OF INSPECTIONS AND TESTS

- A. Backfilling: Requirements for sampling and testing backfilled materials.
- B. Testing required:
  1. Modified proctor maximum density determination tests for each soil

type.

2. Field in-place density tests at intervals not to exceed 300 ft. on sub-base and base material.
3. Thickness test for asphaltic concrete surfacing and concrete parking. Cores shall be taken at a maximum of 250 ft. The minimum thickness allowed shall be 1/4" less than the required average thickness.
4. Extraction stability and gradation of combine aggregate - one test per 200 tons or part with minimum of one per day. Bitumen content, stability and gradation of aggregate to conform to intent of job mix formula.
5. Provide concrete mix designs as required under Specifications Sections 02520 and 03300.
6. Strength test for each 50 cubic yard of concrete placed per day.
7. Visual inspection of all bar joist bearing ends for compliance with specifications.
8. Visual inspection of all metal roof deck structural welds.

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. Temporary utilities required include but are not limited to:
  - 1. Water service and distribution
  - 2. Temporary electric power and lights
  - 3. Telephone service & DSL Service
  - 4. Sanitary facilities
- C. 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. Pumps to control water table during construction activities.
  - 9. Construction aids and miscellaneous services and facilities.
- D. 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, gates

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 or if not indicated as required to maintain site security and safety.
- 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 and as required in zoning ordinances. Provide and maintain silt fences. Protect 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, to 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.

9. Security and Maintenance

- a. Vehicular and pedestrian gates shall be securely locked at all times when no work is in progress and when not required for construction activities. During all work hours, gates which must be open shall be continuously monitored by the Contractor to prevent unauthorized personnel or vehicles from entering the construction site.
- b. Fencing shall be as specified in 1.02 D above and shall prevent pedestrian travel through the site for any reason.
- c. Temporary fencing shall be removed only for construction reasons. If temporary fencing removal is required for non-construction reasons, fencing shall be immediately replaced and secured as soon as the activity for which its removal was required is completed, or if the activity cannot be completed by the end of the work day, temporary security measures shall be taken by the Contractor to ensure that there is no breach of security even during off-work periods.
- d. No Trespassing and similar signs shall be posted at gates and along fencing adjacent to public areas to inform non-construction personnel of the reason for the fence and potential hazards of entering the construction site. Said signs shall be of a size and spacing to be legible from any point along the entire perimeter of the construction site.

1.03 SUBMITTALS

- A. Temporary Utilities: Submit reports of tests, inspections, meter readings and similar procedures performed on temporary utilities.

1.04 QUALITY ASSURANCE

- A. Regulations: Comply with industry standards and applicable laws and regulations if authorities having jurisdiction, including but not 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, A 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, or permit them to interfere with progress. Do not allow hazardous dangerous or unsanitary conditions, or 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. Project Identification: Provide a sign size 4'-0" x 8'-0", shall have 1) County seal, 2) Name of project, 3) Name of County Chairman, 4) Name of County Commissioners, 5) Consultant Team, 6) General Contractor. Locate to provide an unobstructed view from adjoining roadway. Remove project sign upon final completion acceptance.
  
- G. 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.

- H. 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.

- I. 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; if acceptable to the Project Manager, undamaged previously used materials in serviceable condition may be used. Provide materials suitable for the use intended.
- B. Lumber and Plywood: Comply with requirements in Division 6 Section Rough Carpentry.
- 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 posts, 1 2" I.D. for line posts and 2 2 I.D. for corner posts.

## 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 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 241 Standard for Safeguarding Construction, Alterations 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 possibility that air, waterways and subsoil might be contaminated or polluted, or that other undesirable effects might result. Avoid use of tools and equipment which produce harmful noise. Restrict use of noise making tools and equipment to hours that will minimize complaints from persons or firms near the site.

### 3.03 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.

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 Contractors selection of products for use in the Project.
  - 1. Multiple Prime Contracts: Provisions of this Section apply to the construction activities of each prime Contractor.
- B. The Contractors Construction Schedule and the Schedule of Submittals are included under Section 01300 Submittals.
- C. Standards: Refer to Section Definitions and Standards for applicability of industry standards to products specified.
- D. 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 manufacturers' product name, including make or model designation, indicated in the manufacturers 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 or 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 SUBMITTALS

- A. Product List Schedule: Prepare a schedule showing products specified in a tabular form acceptable to the Project Manager. Include generic names of products required. Include the manufacturers name and proprietary product names for each item listed.
  1. Coordinate the product list schedule with the Contractors Construction Schedule and the Schedule of Submittals.
    - a. Related Specification Section Number
    - b. Generic name used in Contract Documents
    - c. Proprietary name, model number and similar designations.
    - d. Manufacturers name and address
    - e. Suppliers name and address
    - f. Installers name and address
    - g. Projected delivery date, or time span of delivery period.
  2. Initial Submittal: Within 30 days after date of commencement of the Work, submit 3 copies of an initial product list schedule. Provide a written explanation for omissions of data, and for known variations from Contract requirements.
    - a. At the Contractors option, the initial submittal may be limited to product selections and designations that must be established early in the Contract period.
  3. Complete Scheduled: Within 45 days after date of commencement of the Work, submit 3 copies of the completed product list schedule. Provide a written explanation for omissions of data, and for known variations from Contract requirements.

4. Architects Action: The Architect will respond in writing to the Contractor within 2 weeks of receipt of the completed product list schedule. No response within this time period constitutes no objection to listed manufacturers or products, but does not constitute a waiver of the requirement that products comply with Contract Documents. The Architects response will include the following:
  - a. A list of unacceptable product selections, containing a brief explanation of reasons for this action.

#### 1.05 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 manufacturers or producers 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 an 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

#### 1.06 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Deliver, store and handle products in accordance with the manufacturers' 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 manufacturers original sealed container or 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 manufacturers 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 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. Manufacturers recommendations may be contained in published product literature, or by the manufacturers' certification of performance.
  5. Compliance with Standards, Codes and Regulations: Where the Specifications only requires 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 Architects 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 ... as selected from manufacturers 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.

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 requests for substitutions made after award of the Contract.
- B. The Contractors Construction Schedule and the Schedule of Submittals are included under Section Submittals.
- C. Standards: Refer to Section Definitions and Standards for applicability of industry standards to products specified.
- D. Procedural requirements governing the Contractors 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 construction 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 these substitutions requested by Bidders during the bidding period, and accepted prior to award of Contract, are considered as included in the Contract Documents and are not subject to requirements specified in this Section for substitutions.
  - 2. Revisions to Contract Documents requested by the Owner or Architect.

3. Specified options of products and construction methods included in Contract Documents.
4. The Contractors 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 ninety (90) 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 Contractors, that will become necessary to accommodate the proposed substitution.
    - e. A statement indicating the substitutions effect on the Contractors 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.





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 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 Contractors submittal and Project Managers 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 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 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.
- B. See Division 16 for additional substitution requirements for Electrical work.

#### **1.02 SUMMARY**

- A. This Section specifies administrative and procedural requirements for handling request for substitutions made during bidding and after award of the Contract.
- B. The Contractor's Installation Schedule and the Schedule of Submittals are included under Section "Submittals".
- C. Standards: Refer to Section "Definitions and Standards" 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: The Contract will be awarded based on the design, methods, materials and/or equipment as addressed in the Contract Drawings and/or described in the Contract Specifications, without any consideration for substitution or "or-equal" replacement. Addressing, describing or naming an item is intended to establish the type, function, characteristics and quality required in order to establish a base for bidding.
  - a. Within thirty (30) days after Contract award, the Contractor may submit for approval substitutes for any equipment and/or material. In addition to the product documents, a written certification shall accompany the documentation indicating that the proposed substitute will have the same characteristics, will perform in accordance with the design requirements and that complies with all the requirements set for in the Contract. Any additional information required by the Owner or County Representative shall be provided by the Contractor. Rejection of any proposed substitute will be considered final and the Contractor shall not get into any agreement with manufacturers or providers until the submittal has been finally approved.
  - b. The submission of this documentation shall follow the requirements set quality required in order to establish a base for bidding.

1.04 SUBMITTALS

- A. Substitution Request Submittal: Request for substitution will be considered if received within thirty (30) days after contract award. 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 Contractors 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. Architect's 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.

## PART2 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

THREE POINTS MAINTENANCE FACILITY  
ORANGE COUNTY, FLORIDA

SECTION 01631  
PRODUCT SUBSTITUTION



## **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)
  - 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 16.
- 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 coincides 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 Project Manager/Consultants and the Owner. Cost will be deducted from the Contractors 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 completed operations where required.
2. Submit and updated final statement, accounting for final

additional changes to the Contract Sum.

3. Submit a certified copy of the Project Managers final inspection list of item 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 Project Manager 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 Project Manager.
1. Upon completion of reinspection, the Project Manager 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 Project Managers reference during normal working hours.
- B. Record Drawings: Maintain a clean, undamaged set of blue or black line white-prints of Contractor 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 Owners 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, an 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 Project Manager for the Owners 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 manufacturers 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 Project Manager 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 Project Manager 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 Owners 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-inc, 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 requires regular maintenance. If installers are not experienced in procedures, provide instruction by manufacturers representatives. All items to be provided or completed 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 ½" 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. Manufacturers 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.

### 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 manufacturers 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. Apply floor wax to vinyl floors.

- 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 Owners 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 Owners property, arrange for disposition of these materials as direct.

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 Contract Documents, including manufacturers 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 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 16.
  - 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 do 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, obligations, 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 Countys 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 Architects 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 (15) 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 execution by the required parties. Submit a draft to the Owner through the Architect for approval prior to final execution.
1. Refer to individual Sections of Division 2 through 16 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 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 1/2" 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 02010-SOIL REPORT AND RECOMMENDATIONS**

Geotechnical Engineering Report, Proposed Three Points Maintenance Facility, Orange County Florida, January 2, 2014, PO No. C11903A030, Nodarse/Page One Project No. AK 125009 it follows and is herewith made part of the specifications for the project.

---

# Geotechnical Engineering Report

## Proposed Three Points Maintenance Facility Orange County, Florida

January 2, 2014

PO No. C11903A030

Nodarse / Page One Project No. AK125009

**Prepared for:**

Orange County Public Works  
Orlando, Florida

**Prepared by:**

Nodarse / Page One Joint Venture, LLC  
Winter Park, Florida

January 2, 2014

Orange County Public Works  
400 East South Street, Suite 500  
Orlando, Florida 32801

Attn: Mr. Roan Waterbury  
P: [407] 836-0034  
F: [407] 836-0051  
E: Roan.Waterbury@ocfl.net

Re: Design Level Geotechnical Engineering Report  
Proposed Three Points Maintenance Facility  
Orange County, Florida  
PO No. C11903A030  
Nodarse / Page One Project Number: AK125009

Dear Mr. Waterbury:

Nodarse / Page One Joint Venture, LLC (Nodarse / Page One) has completed the design level geotechnical engineering services for the above-referenced project. This study was performed in general accordance with our proposal dated October 10, 2013. A preliminary geotechnical engineering report dated January 3, 2013 was previously prepared by Nodarse/Page One for the site. Since the previous report, a site plan has been developed and additional geotechnical exploration was performed in proposed structure locations

We appreciate the opportunity to be of service to you on this project. If you have any questions concerning this report, or if we may be of further service, please contact us.

Sincerely,  
**Nodarse / Page One Joint Venture, LLC**

Shenna McMaster, P.E.  
Senior Geotechnical Engineer  
Florida PE #57537

Bruce H. Woloshin, P.E.  
Principal

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## Geotechnical Engineering Report

Proposed Three Points Maintenance Facility ■ Orange County, Florida  
January 2, 2014 ■ Nodarse / Page One Project No. AK125009



## EXECUTIVE SUMMARY

A geotechnical exploration has been performed for the proposed Three Points Maintenance Facility site located on the east side of Young Pine Road near Derringer Drive in Orange County, Florida. A previous subsurface exploration performed on this site consisted of eleven (11) Standard Penetration Test (SPT) borings to a depth of 20 feet, four (4) auger borings to a depth of 15 feet, and six (6) auger borings to a depth of 5 feet throughout the site. The recent exploration consisted of ten (10) additional SPT borings to depths of 10 to 20 feet in the proposed structure areas.

Based on the information obtained from our geotechnical exploration, it appears that the site can be developed for industrial/office use. The following geotechnical considerations were identified:

- Lightly loaded structures may be supported on shallow footings bearing on the existing site soil or on newly placed engineered fill.
- Assuming proper site preparation and any necessary subgrade repair, total and differential settlement should be within typical performance ranges.
- In-place upper sands typically appear suitable for re-use as general engineered fill while the clayey to silty sands do not appear well-suited for reuse as engineered fill.
- Due to relatively shallow groundwater levels observed at the site, the use of a wet bottom stormwater pond appears feasible.

This summary should be used in conjunction with the entire report for design purposes. It should be recognized that details were not included or fully developed in this section, and the report must be read in its entirety for a comprehensive understanding of the items contained herein. The section titled **GENERAL COMMENTS** should be read for an understanding of the report limitations.

# GEOTECHNICAL ENGINEERING REPORT

## PROPOSED THREE POINTS MAINTENANCE FACILITY

### ORANGE COUNTY, FLORIDA

Nodarse / Page One Project No. AK125009

January 2, 2014

## 1.0 INTRODUCTION

A geotechnical exploration has been performed for the proposed Three Points Maintenance Facility site located on the east side of Young Pine Road near Derringer Drive in Orange County, Florida. The previous subsurface exploration performed on this site consisted of eleven (11) Standard Penetration Test (SPT) borings (TB-1 through TB-11) to a depth of 20 feet, four (4) auger borings (PB-1 through PB-4) to a depth of 15 feet, and six (6) manual auger borings (HA-1 through HA-6) to a depth of 5 feet throughout the site. The recent exploration consisted of ten (10) additional SPT borings (B-1 through B-10) to depths of 10 to 20 feet in the proposed structure areas. Logs of the borings are included as Exhibits A-4 through A-6 in the Appendix of this report, along with a Topographic Vicinity Map (Exhibit A-1), a Soils Map (Exhibit A-2), and a Boring Location Plan (Exhibit A-3).

The purpose of these services is to provide information and geotechnical engineering recommendations/constraints to development relative to:

- subsurface soil conditions
- foundation design
- groundwater conditions
- pavement design
- earthwork
- stormwater management design

## 2.0 PROJECT INFORMATION

### 2.1 Project Description

ITEM	DESCRIPTION
<b>Structures</b>	The project involves construction of a fuel island, administrative buildings, a fleet maintenance/garage structure, and material bins. A site plan with the proposed locations of the structures was provided by you.
<b>Finished Floor Elevations</b>	Not yet determined. Based upon the encountered site conditions, we anticipate fill on the order of about 2 feet will be required to bring the site to final grade.
<b>Design Traffic</b>	Standard duty:                   30,000 E <sub>18</sub> SALs (assumed <sup>1</sup> ) Heavy duty:                       50,000 E <sub>18</sub> SALs (assumed <sup>1</sup> )
<b>Stormwater Management System</b>	A wet detention pond is indicated on the provided site plan to accommodate stormwater runoff volume.

## 2.2 Site Location and Description

Item	Description
<b>Location</b>	The project will be located on the east side of Young Pine Road near Derringer Drive in Orange County, Florida. The property is approximately 15 acres in size.
<b>Existing Improvements</b>	No existing structures on site. Low-lying areas are mapped at the eastern side of the site.
<b>Current Ground Cover</b>	Mostly wooded, often densely so. Grass covers the surface of less wooded areas.
<b>Existing Topography</b>	Site currently appears nearly level. The USGS topographic quadrangle maps “Oviedo SW, FL,” and “Narcoossee NW, FL,” depict the upland portions of the site as generally being above an elevation of +80 feet referencing the National Geodetic Vertical Datum of 1929 (NGVD29). The low-lying areas are depicted below an elevation of +80 feet.

## 3.0 SUBSURFACE CONDITIONS

The geology of the site is presented in the following report section. A brief description of the shallow subsurface soils, as interpreted from the USDA – SCS Soil Survey follows the Geology section. A discussion of subsurface conditions encountered in our borings is presented in the Typical Profile section, following the USDA – SCS Soil Survey section.

### 3.1 Geology

#### 3.1.1 Regional Geology

According to Water Resources of Orange County, Florida, Florida Geologic Survey (FGS) Report of Investigation (RI) 50 (Lichtler, Anderson, and Joyner, 1968), the lithology of the site vicinity generally consists of undifferentiated sand with shell beds, underlain by interbedded sand, clay, and marl belonging to the Hawthorn Formation (since upgraded to Group status, hereinafter referred to as such), in turn underlain by the Ocala Group limestone. FGS RI 50 discusses deeper formations; however, the deeper formations are not considered relevant to this study and are not summarized herein. As interpreted from Cross Section A-A' of Figure 6 of RI 50, the undifferentiated sand with shell beds extends to about 20 feet below mean sea level and the Hawthorn Group extends to about 100 feet below mean sea level.

## Geotechnical Engineering Report

Proposed Three Points Maintenance Facility ■ Orange County, Florida

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### 3.1.2 General Potential for Sinkhole Development

The USGS has prepared a map which identifies areas of sinkhole occurrence in Florida. This map, the Sinkhole Type, Development, and Distribution in Florida map (prepared by the USGS, in cooperation with state agencies, 1985), divides Florida into four areas based on the type and thickness of cover overlying soluble rock. These areas, designated I through IV, have varying potentials for sinkhole development as follows:

- Area I – Sinkholes are few.
- Area II – Sinkholes are few.
- Area III – Sinkholes are numerous.
- Area IV – Sinkholes are very few.

Review of the map listed above indicates the site is located in Area II.

Area II typically has a sandy soil cover between 30 and 200 feet thick overlying limestone. Sinkholes are few, shallow, and of small diameter and develop gradually. Cover-subsidence sinkholes dominate in Area II.

If the sinkhole potential of the site is to be estimated, additional site-specific data must be obtained. This might include using geophysical methods such as electrical resistivity tests and/or ground penetrating radar (GPR) as well as additional geotechnical tests such as Cone Penetrometer Test (CPT) soundings and/or more/deeper Standard Penetration Test borings. Interpretation of the test data should be done by a professional engineer/geologist familiar with the use of these tests under local conditions. If requested, Nodarse/Page One can assist in assessing the sinkhole potential of the location of the proposed construction.

### 3.2 USDA – SCS Soil Survey

The Soil Survey of Orange County, Florida, as prepared by the United States Department of Agriculture (USDA), Soil Conservation Service (SCS; later renamed the Natural Resource Conservation Service - NRCS), dated August 1989, identifies the following soil types at the subject site: St. Johns fine sand (37); Samsula muck (40); and Smyrna fine sand (44). It should be noted that the Soil Survey is not intended as a substitute for site-specific geotechnical exploration; rather it is a useful tool in planning a project scope in that it provides information on soil types likely to be encountered. Boundaries between adjacent soil types on the Soil Survey maps are approximate. Descriptions of these soil map units are included in the Appendix as Exhibit A-2A. A copy of the pertinent section of the print edition of the Soil Survey map is included as Exhibit A-2 in the Appendix.

## Geotechnical Engineering Report

Proposed Three Points Maintenance Facility ■ Orange County, Florida

January 2, 2014 ■ Nodarse / Page One Project No. AK125009



A Terracon COMPANY



### 3.3 Typical Profile

Based on the results of the borings, subsurface conditions on the project site can be generalized as follows:

Stratum	Approximate Depth to Bottom of Stratum (feet)	Material Description	Consistency/Density
1	4 to 10	Mostly fine sand (SP) and fine sand with silt (SP-SM) with lenses of silty sand (SM) <sup>1</sup>	Very Loose to Loose
2	At least 20	Mostly fine sand (SP) and fine sand with silt (SP-SM) with lenses of silty sand (SM) <sup>2</sup>	Medium Dense to Dense <sup>3</sup>

- 1 Surficial slightly organic soils (topsoil) were observed in many borings within the upper few inches to a foot.
- 2 Clayey sand (SC) was observed in Boring TB-9, performed in the proposed stormwater pond location, at a depth of about 13 to 18 feet below existing grade.
- 3 Cemented and/or very dense soil conditions were observed in many of the borings at depths of 6 to 10 feet below existing grade.

Conditions encountered at each boring location are indicated on the individual boring logs. Stratification boundaries on the boring logs represent the approximate location of changes in soil types; in-situ, the transition between materials may be gradual. Details for each of the borings can be found on the boring logs on Exhibits A-4 through A-8 in the Appendix of this report.

### 3.4 Groundwater

The boreholes were observed during drilling for the presence and level of groundwater. Groundwater was observed in all of the borings, between depths of 1 and 3 feet below existing grade during the previous field exploration. During the recent field exploration, groundwater levels were observed at depths of 3 to 4 feet below existing grade. Longer term monitoring in cased holes or piezometers, possibly installed to greater depths than explored under this project scope, would be required to better define groundwater conditions at the site.

It should be recognized that fluctuations of the groundwater table will occur due to seasonal variations in the amount of rainfall, runoff and other factors not evident at the time the borings were performed. In addition, perched water can develop within higher permeability soils overlying less permeable soils. Therefore, groundwater levels during construction or at other times in the future may be higher or lower than the levels indicated on the boring logs.

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We estimate that during the normal wet season (typically June through October) with rainfall and recharge at a maximum, groundwater levels will range from 0 feet (water at or above the ground surface) to about 1 foot below the existing grade. Our estimates of the normal seasonal groundwater conditions are based on the USDA Soil Survey, the encountered soil types, the results of our laboratory testing, and the encountered water levels. The estimated normal seasonal high groundwater tables are shown adjacent to the soil boring profiles on Exhibits A-4 through A-8 in the Appendix.

Estimates of the normal seasonal high water table presented in this report are based on and limited by the data collected during our geotechnical exploration, and the referenced published documents. Estimates of the normal seasonal high assume normal precipitation volumes and distribution. These seasonal water table estimates do not represent the temporary rise in water table that occurs immediately following a storm event, including adjacent to other stormwater management facilities. This is different from static groundwater levels in wet ponds and/or drainage canals which can affect the design water levels of new, nearby ponds. The seasonal high water table may vary from normal when affected by extreme weather changes, localized or regional flooding, karst activity, future grading, drainage improvements, or other construction that may occur on or around the site following the date of this report.

## 4.0 LABORATORY TESTING

The soil samples retrieved from the boring locations were transported to our laboratory for visual examination and selective soil testing. Laboratory testing consisted of moisture content, percent fines, organic content, and Atterberg Limits. The results of our laboratory testing are presented adjacent to the boring profiles on Exhibits A-4 through A-8 in the Appendix.

## 5.0 RECOMMENDATIONS FOR DESIGN AND CONSTRUCTION

### 5.1 Geotechnical Considerations

Based on our understanding of the proposed development and subsurface conditions observed during the field exploration, it is our opinion that the site is suitable for supporting industrial/office development on shallow spread footings if the recommended site preparation procedures are implemented at the site. The site also appears suitable for support of concrete and asphalt pavements. Heavier structural loads may require more thorough site preparation for support on structural loads. The primary issue for support on shallow foundations appears to be proper densification of site sands to control settlements to within tolerable levels.

## Geotechnical Engineering Report

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The predominantly sandy soils observed are generally suitable for reuse as structural fill. Due to the higher fines (silt) content of the siltier and clayey sands observed, extended drying times and greater moisture control may be necessary when reusing these excavated soils as new fill. Also, due to their higher fines content, the silty and clayey sands soils have lower permeability and should not be used where drainage is a concern, i.e. in the vicinity of stormwater management systems, beneath concrete pavements, beneath floor slabs, etc.

We anticipate stabilizing material or off-site borrow fill may be necessary for the construction of stabilized pavement subbase/subgrade courses where asphalt sections are used. Based on the relatively shallow groundwater levels, we anticipate several feet of fill will be added to the site.

Potential limitations to be considered during stormwater management design are the relatively shallow groundwater levels and the relatively shallow semi-confining soils.

Our geotechnical recommendations regarding design and construction of foundations, floor slabs, pavements, and stormwater management are provided in the following sections.

## 5.2 Earthwork

### 5.2.1 Dewatering

Although groundwater was encountered in the soil borings at depths generally greater than about 2½ feet, groundwater will be shallower during the wet season. Depending on the time of year that construction progresses and the required depth of compaction, the potential need for dewatering exists. Therefore we recommend that the contractor verify the groundwater conditions/depth immediately prior to construction. The design of a dewatering system falls under the contractor's choice of "means and methods", and should be designed by a qualified contractor. Dewatering should maintain a separation of at least 2 feet between the groundwater and all compaction surfaces.

### 5.2.2 Difficult Excavations

Due to the presence of dense and very dense cemented hardpan soils within the anticipated excavation depth, difficult excavations should be anticipated. The Contractor should be prepared to utilize specialized equipment and/or methods to facilitate difficult excavations.

### 5.2.3 Site Preparation

We anticipate construction will be initiated by clearing the trees and stripping topsoil. These materials should be removed from the entire construction area. Stripping depths between our boring locations and across the site could vary and we recommend actual stripping depths be evaluated by a representative of Nodarse / Page One during construction.



## Geotechnical Engineering Report

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Once stripping is complete, the subgrade should be proof-rolled where possible to aid in locating loose or soft areas. Proof-rolling can be performed with appropriate heavy equipment to obtain a minimum compaction as defined in Section 5.2.4. Unstable soil (pumping) should be removed or moisture conditioned and compacted in place prior to placing fill.

### 5.2.4 Material Requirements

Compacted structural fill should meet the following material property requirements:

Fill Type <sup>1</sup>	USCS Classification	Acceptable Location for Placement
General <sup>1</sup>	SP (fines content less than 5 percent)	All locations and elevations.
	SP-SM (fines content between 5 and 12 percent) <sup>2</sup>	Locations and elevations where drainage is not a concern, except strict moisture control will be required during placement, particularly during the rainy season.

1. Controlled, compacted fill should consist of approved materials that are non-plastic and free of organic matter and debris.
2. If fines contents are greater than 12 percent, special design and construction procedures may be necessary.

### 5.2.5 Compaction Requirements-Mass Fill Areas

Item	Description
<b>Fill Lift Thickness</b>	12 inches or less in loose thickness when heavy compaction equipment is used in vibratory mode. Lift thickness should be decreased if static compaction is being used, typically to no more than 8 inches, and the required compaction must still be achieved. 4 to 6 inches in loose thickness when hand-guided equipment (i.e. jumping jack or plate compactor) is used.
<b>Minimum Compaction Requirements<sup>1</sup></b>	95 percent of the material's maximum modified Proctor dry density (ASTM D 1557)
<b>Moisture Content<sup>2</sup></b>	Within $\pm 2$ percent of optimum moisture content as determined by the Modified Proctor test, at the time of placement and compaction.
<b>Minimum Testing Frequency</b>	One field density test per 25,000 square feet or fraction thereof per 1-foot (or thinner) lift.

1. We recommend that engineered fill be tested for moisture content and compaction during placement. Should the results of the in-place density tests indicate the specified moisture or compaction limits have not been met, the area represented by the test should be reworked and retested as required until the specified moisture and compaction requirements are achieved.
2. Specifically, moisture levels should be maintained low enough to allow for satisfactory compaction to be achieved without the cohesionless fill material pumping when proofrolled.

### **5.2.6 Utility Trench Backfill**

All trench excavations should be made with sufficient working space to permit construction including backfill placement and compaction. Utility trenches are a common source of water infiltration and migration. All utility trenches that penetrate beneath the building should be backfilled with native soils to avoid creating a preferred flow path through the trenches.

### **5.2.7 Grading and Drainage**

Final surrounding grades should be sloped away from the structure on all sides to prevent ponding of water. Gutters, downspouts, or other appropriate methods that direct water a minimum of 10 feet beyond the footprint of the proposed structures are recommended. Site grades should be set considering the estimated seasonal high groundwater presented in Section 3.4.

### **5.2.8 Earthwork Construction Considerations**

After initial proof rolling and compaction, unstable subgrade conditions could develop during general construction operations, particularly if the soils are wetted and/or subjected to repetitive construction traffic. Upon completion of filling and grading, care should be taken to maintain the subgrade moisture content prior to construction of floor slabs and pavements. Construction traffic over the completed subgrade should be avoided to the extent practical. The site should also be graded to prevent ponding of surface water on the prepared subgrades or in excavations. If the subgrade should become desiccated, saturated, or disturbed, the affected material should be removed or these materials should be scarified, moisture conditioned, and recompacted prior to floor slab and pavement construction.

Trees or other vegetation whose root systems have the ability to remove excessive moisture from the subgrade or heave and crack pavement should not be planted adjacent to the pavement. Trees and shrubbery should be kept away from pavement edges a distance at least equal to 1.5 times their expected mature height or canopy diameter. Installation of landscape drains should be considered around the back sides of curbs to collect and control landscape irrigation and other water entering through landscaping from entering the sides of the pavement sections, reducing the potential for water-related damage. Landscape drains should be routed to the stormwater collection or other positive outfall, away from the pavement.

As a minimum, all temporary excavations should be sloped or braced as required by Occupational Health and Safety Administration (OSHA) regulations to provide stability and safe working conditions. Temporary excavations will probably be required during grading operations. The Grading Contractor, by his contract, is usually responsible for designing and constructing stable, temporary excavations and should shore, slope or bench the sides of the excavations as required, to maintain stability of both the excavation sides and bottom. All excavations should comply with applicable local, state and federal safety regulations, including the current OSHA Excavation and Trench Safety Standards.

Nodarse / Page One should be retained during the construction phase of the project to observe earthwork and to perform necessary tests and observations during subgrade preparation; proof-rolling; placement and compaction of controlled compacted fills; backfilling of excavations into the completed subgrade, and just prior to construction of building floor slabs.

### 5.3 Foundations

In our opinion, the proposed structures can be supported by a shallow foundation system bearing on native soil or newly placed fill extending to native soil. Design recommendations for shallow foundations for the proposed structure are presented in the following sections.

#### 5.3.1 Foundation Design Recommendations

Description	Column Footing	Wall Footing	Monolithic Slab Foundation <sup>4</sup>
<b>Net allowable bearing pressure <sup>1</sup></b>	3,000 psf	3,000 psf	3,000 psf
<b>Minimum width</b>	30 inches	18 inches	12 inches
<b>Minimum embedment below finished grade <sup>2</sup></b>	18 inches	18 inches	12 inches
<b>Compaction requirements</b>	95 percent of the materials maximum Modified Proctor dry density for a depth of 12 inches below footing.		
<b>Minimum Testing Frequency</b>	One field density test per footing for a minimum depth of 1 foot below the footing subgrade.	One field density test per 50 linear feet for a minimum depth of 1 foot below the footing subgrade.	One field density test per 50 linear feet for a minimum depth of 1 foot below the footing subgrade.
<b>Approximate total settlement <sup>3</sup></b>	<1 inch	<1 inch	<1 inch
<b>Estimated differential settlement <sup>3</sup></b>	< <sup>3</sup> / <sub>4</sub> inch between columns	< <sup>3</sup> / <sub>4</sub> inch over 40 feet	< <sup>3</sup> / <sub>4</sub> inch over 40 feet

1. The recommended net allowable bearing pressure is the pressure in excess of the minimum surrounding overburden pressure at the footing base elevation. Assumes any unsuitable fill or soft soils, if encountered, will be undercut and replaced with engineered fill.
2. For erosion protection and to reduce effects of seasonal moisture variations in subgrade soils.
3. The foundation settlement will depend upon the variations within the subsurface soil profile, the structural loading conditions, the embedment depth of the footings, the thickness of compacted fill, and the quality of the earthwork operations. The above settlement estimates have assumed that the maximum footing width is 7.5 feet for column footings and 2 feet for continuous footings.
4. Turned-down portion of slab. For slab requirements see Section 5.4.1.



## 5.4 Floor Slabs

### 5.4.1 Floor Slab Design Recommendations

Item	Description
<b>Floor slab support</b>	Free draining granular material meeting the general fill specification. <sup>1</sup>
<b>Modulus of subgrade reaction</b>	100 pounds per square inch per inch (psi/in) for point loading conditions.
<b>Compaction requirements</b>	95 percent of the materials maximum Modified Proctor dry density
<b>Minimum Testing Frequency</b>	One field density test per 2,500 square feet or fraction thereof for a depth of 12 inches. <sup>2</sup>

1. We recommend subgrades be maintained in a relatively moist condition until floor slabs are constructed. If the subgrade should become desiccated prior to construction of floor slabs, the affected material should be removed or the materials scarified, moistened, and recompact. Upon completion of grading operations in the building areas, care should be taken to maintain the recommended subgrade moisture content and density prior to construction of the building floor slabs.
2. Density should be re-checked after utility construction.

Where appropriate, saw-cut control joints should be placed in the slab to help control the location and extent of cracking. For additional recommendations refer to the ACI Design Manual.

The use of a vapor retarder should be considered beneath concrete slabs-on-grade that will be covered with wood, tile, carpet or other moisture sensitive or impervious coverings, or when the slab will support equipment sensitive to moisture. When conditions warrant the use of a vapor retarder, the slab designer and slab contractor should refer to ACI and Florida Building Code (FBC) regarding moisture and radon for procedures and cautions regarding the use and placement of a vapor retarder. We note that FBC requires a minimum of 6-mil polyethylene, which is typically used in Florida. However, local requirements that might affect what moisture barrier may use should also be consulted.

### 5.4.2 Floor Slab Construction Considerations

On most project sites, the site grading is generally accomplished early in the construction phase. We recommend the area underlying the floor slab be rough graded and then thoroughly proofrolled prior to final grading. However as construction proceeds, the subgrade may be disturbed due to utility excavations, construction traffic, desiccation, rainfall, etc. As a result, the floor slab subgrade may not be suitable for placement of concrete and corrective action will be required.

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Particular attention should be paid to high traffic areas that were rutted and disturbed earlier and to areas where backfilled trenches are located. Areas where unsuitable conditions are located should be repaired by removing and replacing the affected material with properly compacted fill. All floor slab subgrade areas should be moisture conditioned and properly compacted to the recommendations in this report immediately prior to placement of concrete.

## 5.5 Pavements

### 5.5.1 Subgrade Preparation

Site grading is typically accomplished relatively early in the construction phase. Fills are placed and compacted in a uniform manner. However, as construction proceeds, excavations are made into these areas, rainfall and surface water saturates some areas, heavy traffic from concrete trucks and other delivery vehicles disturbs the subgrade and many surface irregularities are filled in with loose soils to temporarily improve ride comfort. As a result, the pavement subgrades, initially prepared early in the project, should be carefully evaluated as the time for pavement construction approaches.

We recommend the moisture content and density of the top 12 inches of the subgrade be evaluated and the pavement subgrades be proofrolled and tested within two days prior to commencement of actual paving operations. Compaction tests should be performed at a frequency of 1 test per 10,000 square feet or fraction thereof. Areas not in compliance with the required ranges of moisture or density should be moisture conditioned and recompacted. Particular attention should be paid to high traffic areas that were rutted and disturbed earlier and to areas where backfilled trenches are located. Areas where unsuitable conditions are found should be repaired by removing and replacing the materials with properly compacted fills.

After proofrolling and repairing deep subgrade deficiencies, the entire subgrade should be scarified and prepared as recommended in Section 5.2 of the Earthwork section this report to provide a uniform subgrade for pavement construction. Areas that appear severely desiccated following site stripping may require further undercutting and moisture conditioning. If a significant precipitation event occurs after the evaluation or if the surface becomes disturbed, the subgrade should be reviewed by qualified personnel immediately prior to paving. The subgrade should be in its finished form at the time of the final review.

### 5.5.2 Design Considerations

Traffic patterns and anticipated loading conditions were not available at the time that this report was prepared. However, we anticipate that traffic loads will consist of mostly heavy vehicles. The thickness of pavements subjected to heavy truck traffic should be determined using expected traffic volumes, vehicle types, and vehicle loads and should be in accordance with local, city or county ordinances.



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Pavement thickness can be determined using AASHTO, Asphalt Institute, PCA, and/or other methods if specific wheel loads, axle configurations, frequencies, and desired pavement life are provided. Nodarse/Page One can provide thickness recommendations for pavements subjected to loads other than personal vehicle and occasional delivery and trash removal truck traffic if this information is provided. However, absent that data, we recommend the following minimum typical sections.

### 5.5.3 Estimates of Minimum Pavement Thickness

Typical Pavement Section (inches)						
Traffic Area	Alternative	Asphalt Concrete Surface Course	Limerock, Soil-Cement or Crushed Concrete Base Course	Stabilized Subbase Course <sup>2,3,4</sup>	Portland Cement Concrete	Free Draining Subgrade
Heavy Duty Traffic Areas	PCC	--	--		6.0	18.0
	AC	2.5	8.0	12.0	--	--
Material Bins and Trash Container Pad <sup>1</sup>	PCC	--	--		6.0	18.0

1. These areas should be large enough to support the container and the tipping axle of the collection/hauling trucks.
2. Often referred to as Stabilized Subgrade.
3. Use coarse granular materials such as recycled crushed concrete, shell, or gravel when seasonal high groundwater is within 4 feet of the profile grade. Use of fine admixtures (silty and/or clayey soils) is not recommended due to the relatively high groundwater table on site).
4. Stabilized subbase beneath soil-cement base is not required. However, compaction of the subbase, as recommended below, will be required.

### 5.5.4 Asphalt Concrete Design Recommendations

The following items are applicable to asphalt concrete pavement sections.

- Nodarse/Page One recommends a minimum separation of 12 inches between the bottom of the base course and the seasonal high water table if a soil cement or crushed concrete base is used. If a limerock base is used, a minimum separation of 18 inches is recommended.
- Natural or fill subgrade soils to a depth of 18 inches below the base should be clean, free draining sands with a fines content passing a No. 200 sieve of 7 percent or less.

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- Stabilized subgrade soils (also identified as stabilized subbase) should be stabilized to a minimum Limerock Bearing Ratio (LBR; Florida Method of Test Designation FM 5-515) value of 40 if they do not already meet this criterion, or modified/replaced with new compacted fill that meets the minimum LBR value. Although LBR testing has not been performed, our experience with similar soils indicates that the near surficial sands encountered in the soil borings are unlikely to meet this requirement.
- The subgrade course should be compacted to at least 98 percent of the Modified Proctor maximum dry density (AASHTO T-180 or ASTM D-1557). Any underlying, newly-placed subgrade fill need only be compacted to a minimum of 95 percent of the Modified Proctor maximum dry density. Compaction tests should be performed at a frequency of 1 test per 10,000 square feet or fraction thereof.
- Limerock base courses from an approved FDOT source should have a minimum LBR value of 100, and be compacted to a minimum of 98 percent of the maximum dry density as determined by the Modified Proctor test. Limerock should be placed in uniform lifts not to exceed 6 inches loose thickness. Recycled limerock is not a suitable substitute for virgin limerock for base courses but may be used as a granular stabilizing admixture.
- Soil cement base courses typically experience shrinkage cracking due to hydration curing of the cement. This shrinkage cracking typically propagates through the overlying asphalt course and reflects in the pavement surface. This reflective cracking is not necessarily indicative of a pavement structural failure, though it is sometimes considered to be aesthetically undesirable.
- Soil cement bases should have 7-day design strength of 300 psi. Soil cement base should be compacted to a minimum of 98 percent of the material's maximum dry density as determined by the Standard Proctor Test for Soil Cement (AASHTO T-134). Higher design strengths may result in increased cracking.
- Crushed (recycled) concrete base should meet the current FDOT specification 204 for recycled materials.
- Asphalt should be compacted to a minimum of 95 percent of the design mix density. Asphalt surface courses should be Type SP, Type S, or other suitable mix design according to FDOT and local requirements.
- To verify thicknesses, after placement and compaction of the pavement courses, core the wearing surface to evaluate material thickness and composition at a minimum frequency of 5,000 square feet or two locations per day's production.
- Underdrains or strip drains should be considered along all landscaped areas in, or adjacent to pavements to reduce moisture migration to subgrade soils. Underdrains will also be required below pavement if the separation between the bottom of the base course and the seasonal high groundwater table is less than 1 foot.



- All curbing should be full depth. Use of extruded curb sections which lie on top of asphalt surface courses can allow migration of water between the surface and base courses, leading to rippling and pavement deterioration.

### **5.5.5 Portland Cement Concrete Design Recommendations**

The following items are applicable to rigid concrete pavement sections.

- At least 18 inches of free-draining material should be included directly beneath rigid concrete pavement. Fill meeting the requirements presented in Section 5.2 (Earthwork) of this report may be considered free-draining for this purpose. Limerock should not be considered free draining for this purpose.
- The PCC should be a minimum of 4,000 psi at 28 days. PCC pavements are recommended for material bins and trash container pads and in any other areas subjected to heavy wheel loads and/or turning traffic.
- The upper 1 foot of rigid pavement subgrade soils should be compacted to at least 98 percent of the Modified Proctor maximum dry density (AASHTO T-180 or ASTM D-1557). Compaction tests should be performed at a frequency of 1 test per 10,000 square feet or fraction thereof.
- Rigid PCC pavements will perform better than ACC in areas where short-radii turning and braking are expected (i.e. entrance/exit aprons) due to better resistance to rutting and shoving. In addition, PCC pavement will perform better in areas subject to large or sustained loads. An adequate number of longitudinal and transverse control joints should be placed in the rigid pavement in accordance with ACI and/or AASHTO requirements. Expansion (isolation) joints must be full depth and should only be used to isolate fixed objects abutting or within the paved area.
- Adequate separation should be provided between the bottom of the concrete and the seasonal high water table. Nodarse/Page One recommends that in no case should less than 1 foot of separation be provided.
- Sawcut patterns should generally be square or rectangular but nearly square, and extend to a depth equal to a quarter of the slab thickness. If the bottom of the concrete pavement is separated from the seasonal high water table by at least 1 foot, filter fabric will not be necessary beneath the expansion joints.

### **5.5.6 Pavement Drainage**

Pavements should be sloped to provide rapid drainage of surface water. Water allowed to pond on or adjacent to the pavements could saturate the subgrade and contribute to premature pavement deterioration. In addition, the pavement subgrade should be graded to provide positive drainage within the granular base section. The subgrade and the pavement surface should have a minimum ¼ inch per foot slope to promote drainage. Appropriate sub-drainage or connection to a suitable daylight outlet should be provided to remove water from the base layer.

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### 5.5.7 Pavement Maintenance

The pavement sections provided in this report represent minimum recommended thicknesses and, as such, periodic maintenance should be anticipated. Therefore preventive maintenance should be planned and provided for through an on-going pavement management program. Maintenance activities are intended to slow the rate of pavement deterioration, and to preserve the pavement investment. Maintenance consists of both localized maintenance (e.g., crack and joint sealing and patching) and global maintenance (e.g., surface sealing). Preventive maintenance is usually the first priority when implementing a pavement maintenance program. Additional engineering observation is recommended to determine the type and extent of a cost effective program. Even with periodic maintenance, some movements and related cracking may still occur and repairs may be required.

### 5.6 Stormwater Management

A stormwater pond is anticipated on the eastern portion of the site. Borings TB-8 through TB-10 and HA-6 were performed within or very near the proposed pond location. Soil conditions observed in these borings were mostly fine sand (SP) and fine sand with silt (SP-SM); although lenses of silty fine sand (SM) and clayey fine sand (SC) were observed in Boring TB-9. Groundwater levels were found at depths of 2.5 to 3 feet below existing grade during the field exploration in 2012. Due to relatively high groundwater levels observed, we anticipate the stormwater pond will be a wet bottom pond.

Existing low-lying areas are mapped along the eastern portion of the site. The water levels of these features were not measured during our geotechnical exploration. These water levels should be measured by a registered land surveyor, possibly at different times throughout the year, prior to finalizing a stormwater plan for the anticipated development. Design/construction data for these features should be obtained as necessary, possibly including cross-sections, plans, and stage-storage relationships, preferably from previous reports though it may be necessary to find this information in the permit file for the existing ponds.

We estimate the normal seasonal high water table will generally range from ground surface to 1 foot below the existing grade in the proposed pond location. Seasonal low groundwater levels are expected to be about 4 feet below existing grade. The average wet season water table is expected to be about 2 feet below existing grade in the proposed pond location. The previously noted low-lying features will act as boundary conditions that should be considered during stormwater management design.

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## 6.0 GENERAL COMMENTS

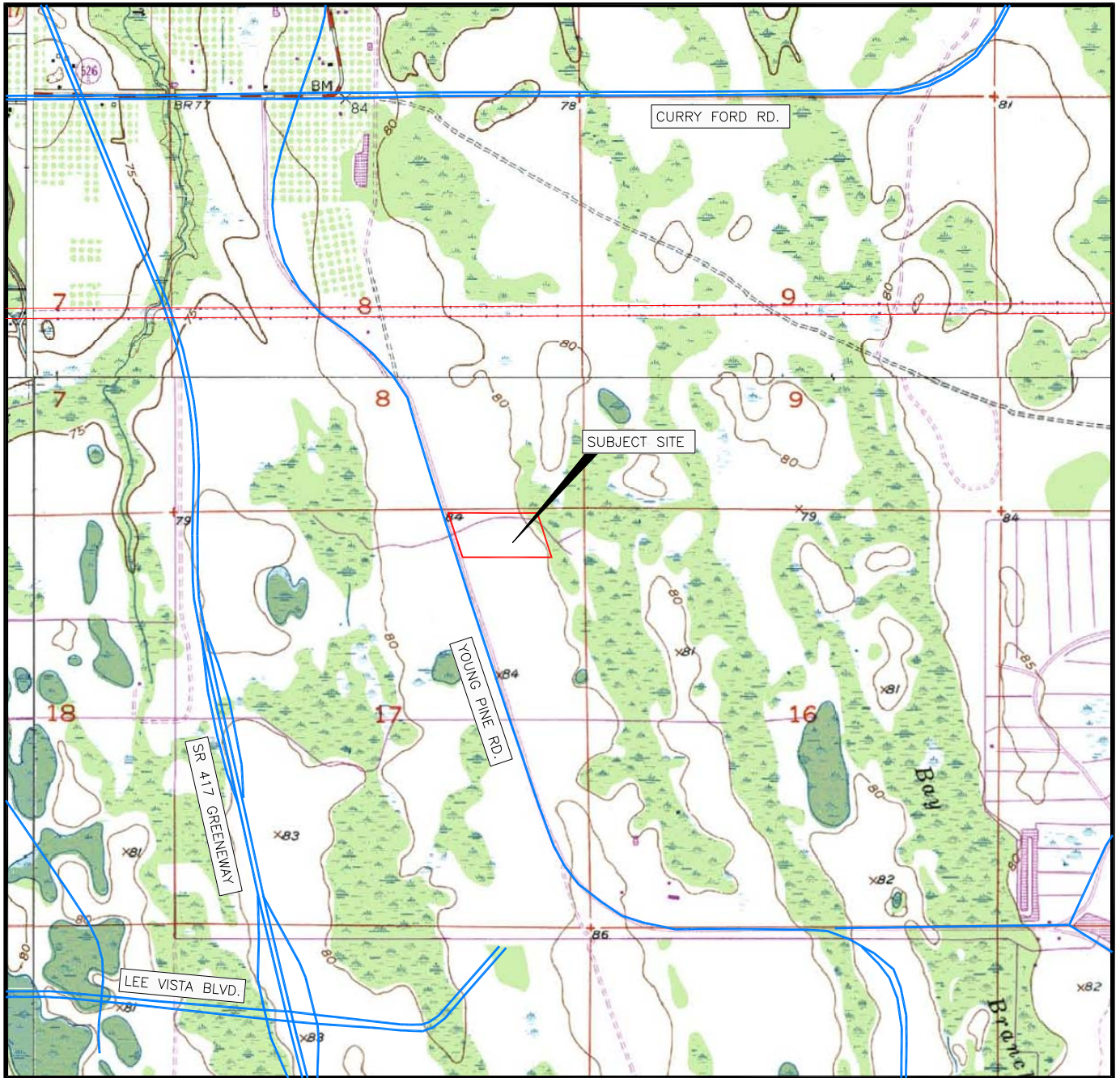
The recommendations contained within this report are based on limited exploration and should be considered preliminary. Nodarse / Page One also should be retained to provide observation and testing services during grading, excavation, foundation construction and other earth-related construction phases of the project.

The analysis and recommendations presented in this report are based upon the limited data obtained from the borings performed at the indicated locations and from other information discussed in this report. This report does not reflect variations that may occur between borings, across the site, or due to the modifying effects of construction or weather. The nature and extent of such variations may not become evident until during or after construction. If variations appear, we should be immediately notified so that further evaluation and supplemental recommendations can be provided.

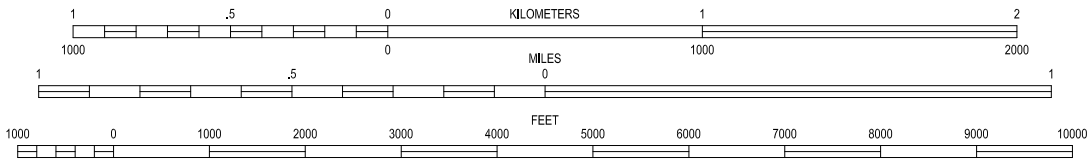
The scope of services for this project does not include either specifically or by implication any environmental or biological (e.g., mold, fungi, bacteria) assessment of the site or identification or prevention of pollutants, hazardous materials or conditions. If the owner is concerned about the potential for such contamination or pollution, other studies should be undertaken.

This report has been prepared for the exclusive use of our client for specific application to the project discussed and has been prepared in accordance with generally accepted geotechnical engineering practices. No warranties, either expressed or implied, are intended or made. Site safety, excavation support, and dewatering requirements are the responsibility of others. In the event that changes in the nature, design, or location of the project as outlined in this report are planned, the conclusions and recommendations contained in this report shall not be considered valid unless Nodarse / Page One reviews the changes and either verifies or modifies the conclusions of this report in writing.

## APPENDIX



SCALE 1:24 000



CONTOUR INTERVAL 5 FEET  
NATIONAL GEODETIC VERTICAL DATUM OF 1929

SECTION: 17  
TOWNSHIP: 23 SOUTH  
RANGE: 31 EAST

OVIEDO SW, FLORIDA  
ISSUED: 1953

REVISED: 1980

NARCOOSSEE NW, FLORIDA  
ISSUED: 1953  
REVISED: 1980

7.5 MINUTE SERIES (QUADRANGLE)



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Jan02, 2014 - 2:29pm

Project Mngr:	SM	Project No.	AK125009
Drawn By:	SW	Scale:	AS SHOWN
Checked By:	SM	File No.	AK125009-1
Approved By:	BHW	Date:	12-16-13

**Nodarse / Page One**  
**Joint Venture**

TOPOGRAPHIC VICINITY MAP  
GEOTECHNICAL ENGINEERING EVALUATION  
THREE POINTS MAINTENANCE FACILITY  
ORANGE COUNTY, FLORIDA

EXHIBIT

A-1



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SCALE 1" = 2000'



U.S.D.A. SOIL SURVEY FOR ORANGE COUNTY, FLORIDA  
ISSUED: 1989

SECTION: 17  
TOWNSHIP: 23 SOUTH  
RANGE: 31 EAST

SOILS MAP INDEX	
3	BASINGER FINE SAND, DEPRESSIONAL
37	ST. JOHNS FINE SAND
40	SAMSULA MUCK
44	SMYRNA FINE SAND



Project Mngr:	SM	Project No.	AK125009
Drawn By:	SW	Scale:	AS SHOWN
Checked By:	SM	File No.	AK125009-2
Approved By:	BHW	Date:	12-16-13

**Nodarse/Page One**  
**Joint Venture**

U.S.D.A. SOILS MAP  
GEOTECHNICAL ENGINEERING EVALUATION  
THREE POINTS MAINTENANCE FACILITY  
ORANGE COUNTY, FLORIDA

EXHIBIT

A-2

Jan02, 2014 - 2:28pm

## Geotechnical Engineering Report

Proposed Three Points Maintenance Facility ■ Orange County, Florida  
January 2, 2014 ■ Nodarse / Page One Project No. AK125009



### Soil Survey Descriptions

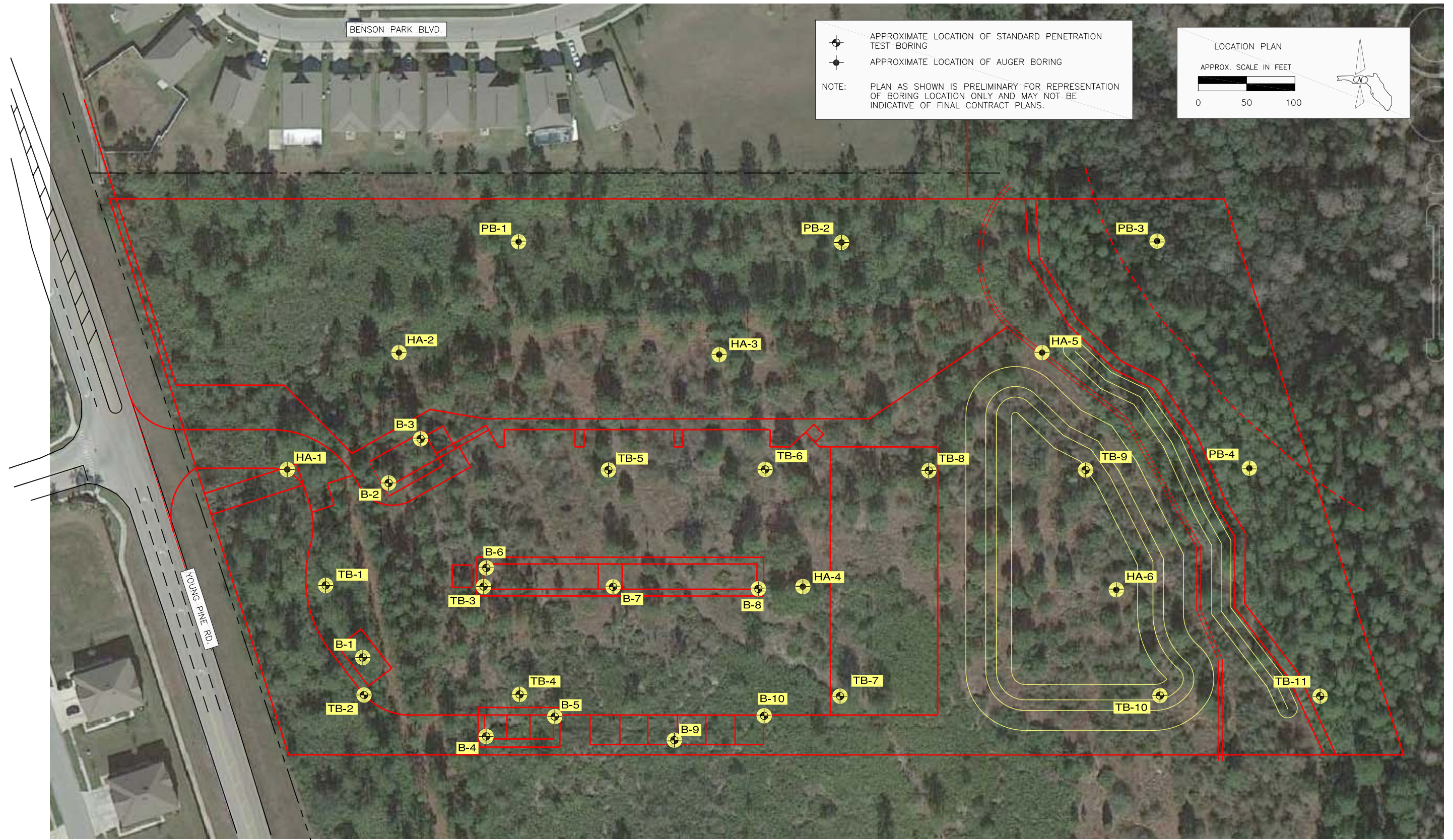
37 – St. Johns fine sand. This soil type is nearly level and poorly drained. It is typically found on broad flats on the flatwoods. In its natural state and during years of normal rainfall, this soil type has a seasonal high water table within 10 inches (0.8 feet) of the surface for 6 to 12 months, receding to a depth of 10 to 40 inches (0.8 to 3.3 feet) for more than six months. This soil type is predominantly sandy except between depths of 24 and 44 inches (2.0 and 3.7 feet), where it exists as fine sand with silt to silty sand.

40 – Samsula muck. This soil type is nearly level and very poorly drained. It is typically found in freshwater swamps and marshes. In its natural state, groundwater is ponded atop this soil type for 6 to 9 months of the year with normal rainfall. A surficial organic layer is normally associated with this soil type, approximately 8 inches thick. Beneath the surficial organic layer, Samsula soils are predominantly sandy to the maximum defined depth of 80 inches.

44 – Smyrna fine sand. This soil type is nearly level and poorly drained. It is typically found on broad flatwoods. In its natural state and during years of normal rainfall, this soil type has a seasonal high water table within 10 inches (0.8 feet) of the surface, receding to a depth of 10 to 40 inches (0.8 to 3.3 feet) for more than six months.



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REVISIONS					
DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION

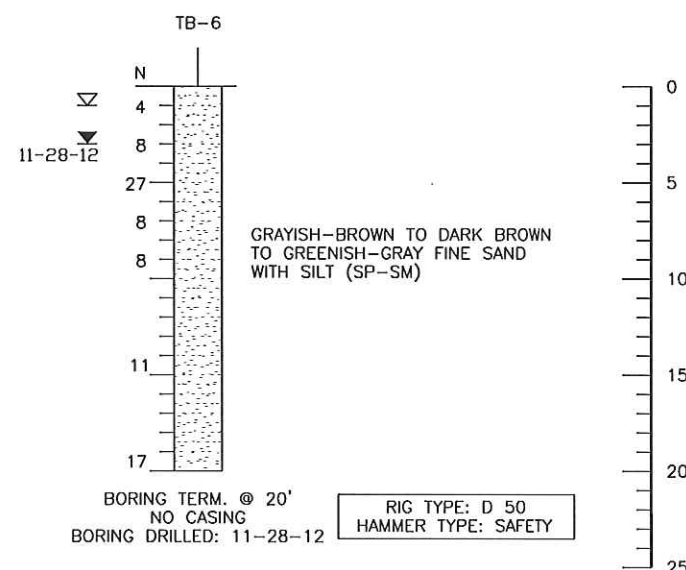
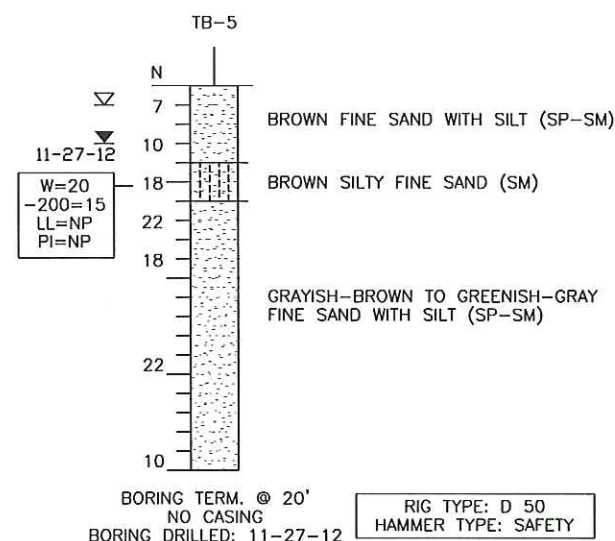
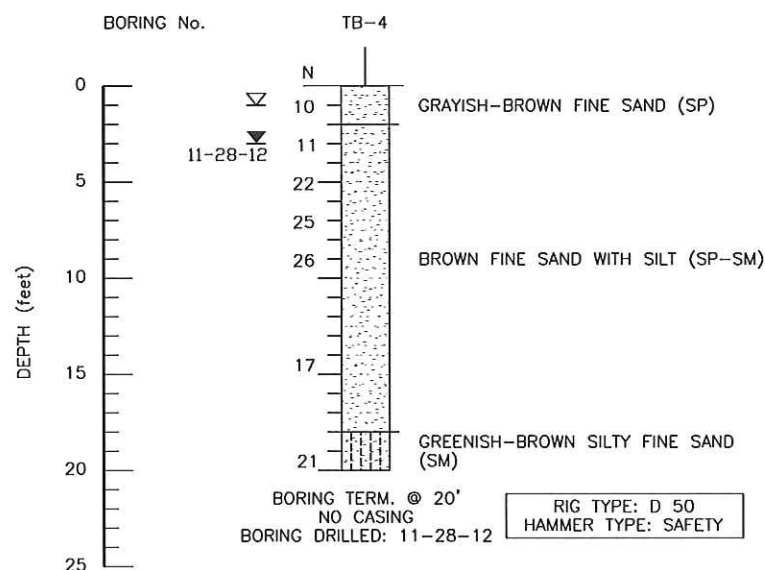
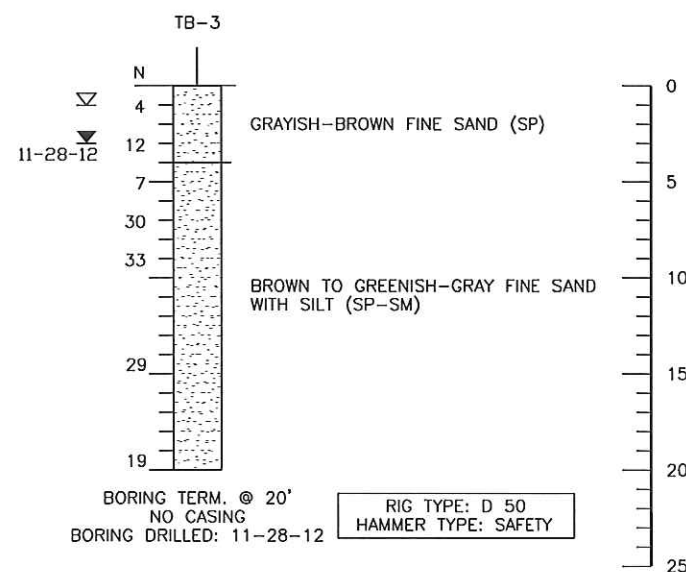
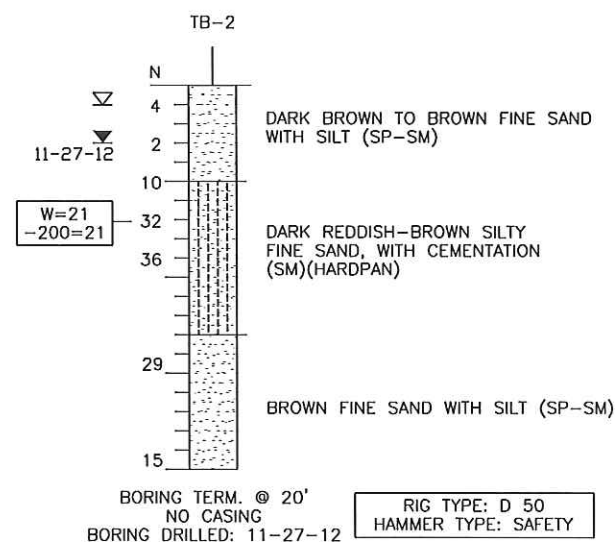
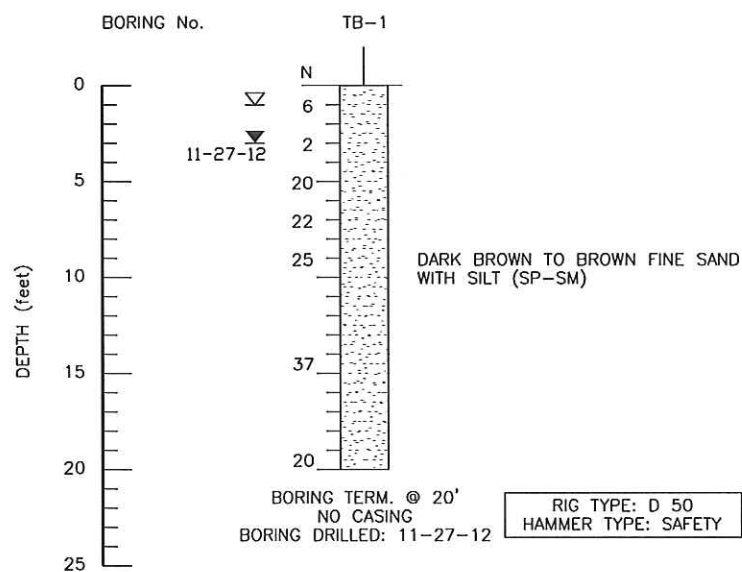
**Nodarse/Page One  
Joint Venture**

DRAWN BY: SW 12-16-13	<b>ORANGE COUNTY PUBLIC WORKS</b>	
CHECKED BY: SM 12-16-13	ROAD NO.	COUNTY
DESIGNED BY:	SR-	ORANGE
CHECKED BY:	FINANCIAL PROJECT ID	-

SHEET TITLE: <i>BORING LOCATION PLAN</i>	REF. DWG. NO.
PROJECT NAME: <i>THREE POINTS MAINTENANCE FACILITY</i>	SHEET NO. -



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 Jun02, 2014 2:48pm



**LEGEND**

	SAND, SAND WITH SILT
	SILTY SAND
	CLAYEY SAND
(SP)	UNIFIED SOIL CLASSIFICATION GROUP SYMBOL
▽	ENCOUNTERED GROUNDWATER LEVEL DATE NOTED
▽	ESTIMATED NORMAL SEASONAL HIGH GROUNDWATER LEVEL
▽	ESTIMATED NORMAL SEASONAL HIGH GROUNDWATER LEVEL ABOVE EXISTING GROUND SURFACE
W=0 -200=0 LL=0 PI=0 NP OC=0	NATURAL MOISTURE CONTENT (%) FINES PASSING No. 200 SIEVE (%) LIQUID LIMIT (%) PLASTICITY INDEX NON-PLASTIC ORGANIC CONTENT (%)
N	STANDARD PENETRATION RESISTANCE IN BLOWS PER FOOT

**STANDARD PENETRATION TEST DATA**

SPoon INSIDE DIA.	1 3/8 in.
SPoon OUTSIDE DIA.	2 in.
ASTM STANDARD DROP SAFETY HAMMER (ROPE-CATHEAD)	
AVG. HAMMER DROP	30 in.
HAMMER WEIGHT	140 lbs.

**GRANULAR MATERIALS**

RELATIVE DENSITY	SPT (BLOWS/FOOT)
VERY LOOSE	LESS THAN 4
LOOSE	4-10
MEDIUM DENSE	10-30
DENSE	30-50
VERY DENSE	GREATER THAN 50

**SILTS AND CLAYS**

CONSISTENCY	SPT (BLOWS/FOOT)
VERY SOFT	LESS THAN 2
SOFT	2-4
FIRM	4-8
STIFF	8-15
VERY STIFF	15-30
HARD	GREATER THAN 30

**ENVIRONMENTAL CLASSIFICATION:**

SUPERSTRUCTURE: N/A  
SUBSTRUCTURE: CONCRETE: N/A  
STEEL: N/A

- NOTES:**
- SUBSURFACE VARIATIONS BETWEEN BORINGS SHOULD BE ANTICIPATED AS INDICATED IN SECTION 2-4 OF THE STANDARD SPECIFICATIONS.
  - ARTESIAN CONDITIONS WERE NOT NOTED BY THE DRILLER. HOWEVER, BASED ON REVIEW OF THE ST. JOHNS RIVER WATER MANAGEMENT DISTRICT POTENTIOMETRIC MAPS OF THE FLORIDAN AQUIFER FOR THE PROJECT AREA, THE POTENTIAL ARTESIAN HEAD ELEVATION IS ESTIMATED TO BE +35 FEET (NGVD).

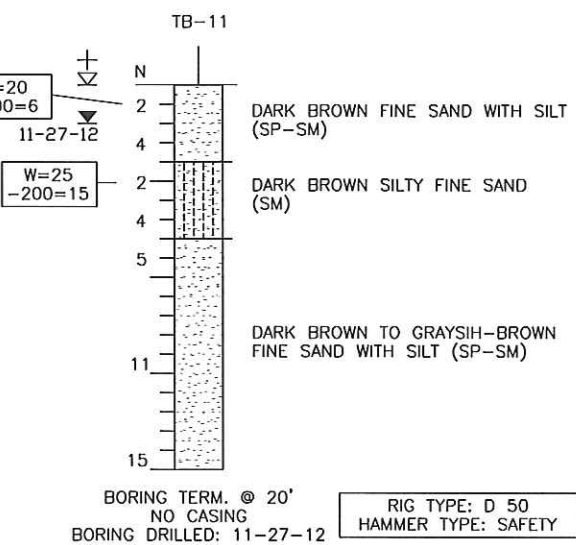
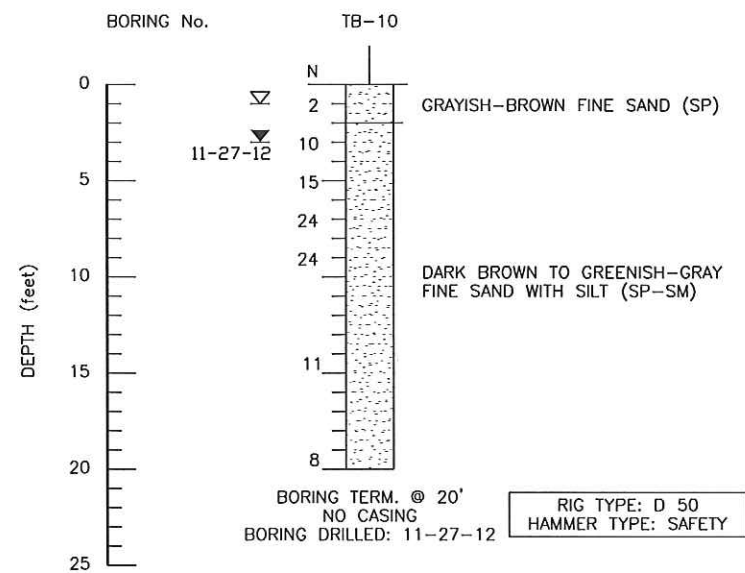
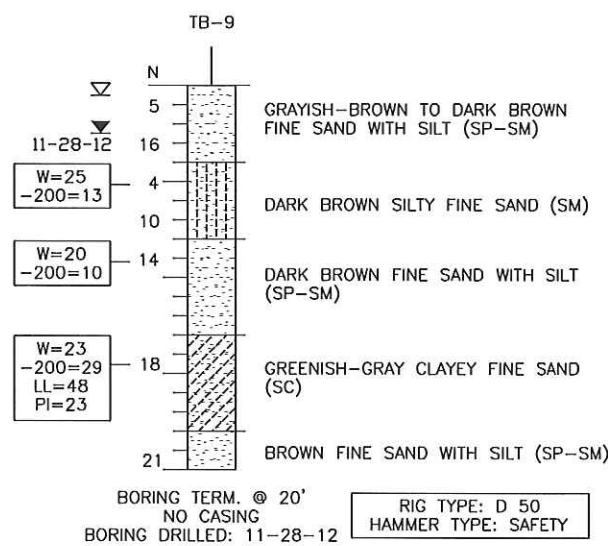
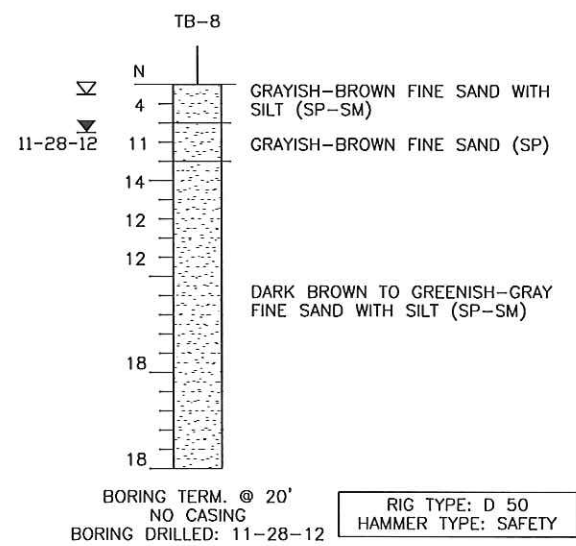
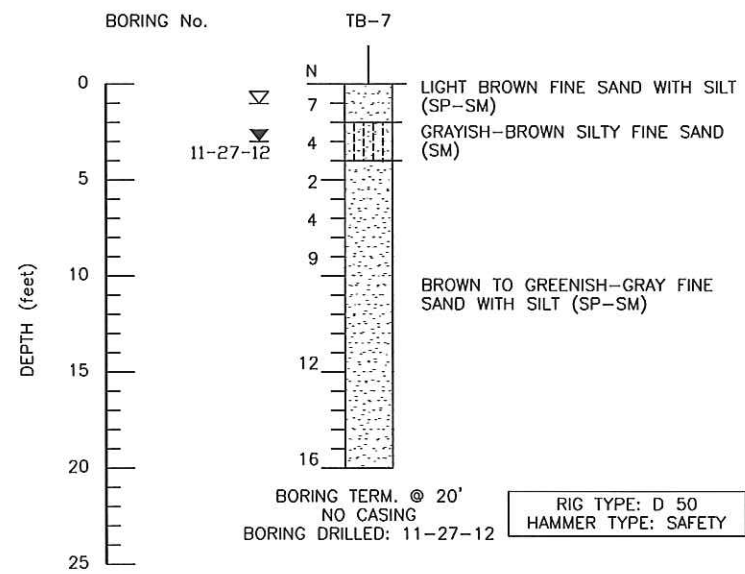
**REVISIONS**

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DRAWN BY: SW 12-18-12			SHEET TITLE: <b>REPORT OF BORINGS</b>			REF. DWG. NO.
CHECKED BY: ENJ 12-18-12			PROJECT NAME: <b>PROPOSED THREE POINTS MAINTENANCE FACILITY</b>			SHEET NO.
DESIGNED BY:	ROAD NO. SR-	COUNTY ORANGE	FINANCIAL PROJECT ID	-		
CHECKED BY:						

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**LEGEND**

SAND, SAND WITH SILT

SILTY SAND

CLAYEY SAND

(SP) UNIFIED SOIL CLASSIFICATION GROUP SYMBOL

ENCOUNTERED GROUNDWATER LEVEL  
DATE NOTED

ESTIMATED NORMAL SEASONAL HIGH GROUNDWATER LEVEL

ESTIMATED NORMAL SEASONAL HIGH GROUNDWATER LEVEL ABOVE EXISTING GROUND SURFACE

W=0 NATURAL MOISTURE CONTENT (%)  
-200=0 FINES PASSING No. 200 SIEVE (%)  
LL=0 LIQUID LIMIT (%)  
PI=0 PLASTICITY INDEX  
NP NON-PLASTIC  
OC=0 ORGANIC CONTENT (%)

N STANDARD PENETRATION RESISTANCE IN BLOWS PER FOOT

**STANDARD PENETRATION TEST DATA**

SPOON INSIDE DIA. 1 3/8 in.  
SPOON OUTSIDE DIA. 2 in.  
ASTM STANDARD DROP SAFETY HAMMER (ROPE-CATHEAD)  
AVG. HAMMER DROP 30 in.  
HAMMER WEIGHT 140 lbs.

**GRANULAR MATERIALS**

RELATIVE DENSITY	SPT (BLOWS/FOOT)
VERY LOOSE	LESS THAN 4
LOOSE	4-10
MEDIUM DENSE	10-30
DENSE	30-50
VERY DENSE	GREATER THAN 50

**SILTS AND CLAYS**

CONSISTENCY	SPT (BLOWS/FOOT)
VERY SOFT	LESS THAN 2
SOFT	2-4
FIRM	4-8
STIFF	8-15
VERY STIFF	15-30
HARD	GREATER THAN 30

**ENVIRONMENTAL CLASSIFICATION:**

SUPERSTRUCTURE: N/A  
SUBSTRUCTURE: CONCRETE: N/A  
STEEL: N/A

- NOTES:**
- SUBSURFACE VARIATIONS BETWEEN BORINGS SHOULD BE ANTICIPATED AS INDICATED IN SECTION 2-4 OF THE STANDARD SPECIFICATIONS.
  - ARTESIAN CONDITIONS WERE NOT NOTED BY THE DRILLER. HOWEVER, BASED ON REVIEW OF THE ST. JOHNS RIVER WATER MANAGEMENT DISTRICT POTENTIOMETRIC MAPS OF THE FLORIDAN AQUIFER FOR THE PROJECT AREA, THE POTENTIAL ARTESIAN HEAD ELEVATION IS ESTIMATED TO BE +35 FEET (NGVD).

**REVISIONS**

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Joint Venture**

**ORANGE COUNTY PUBLIC WORKS**

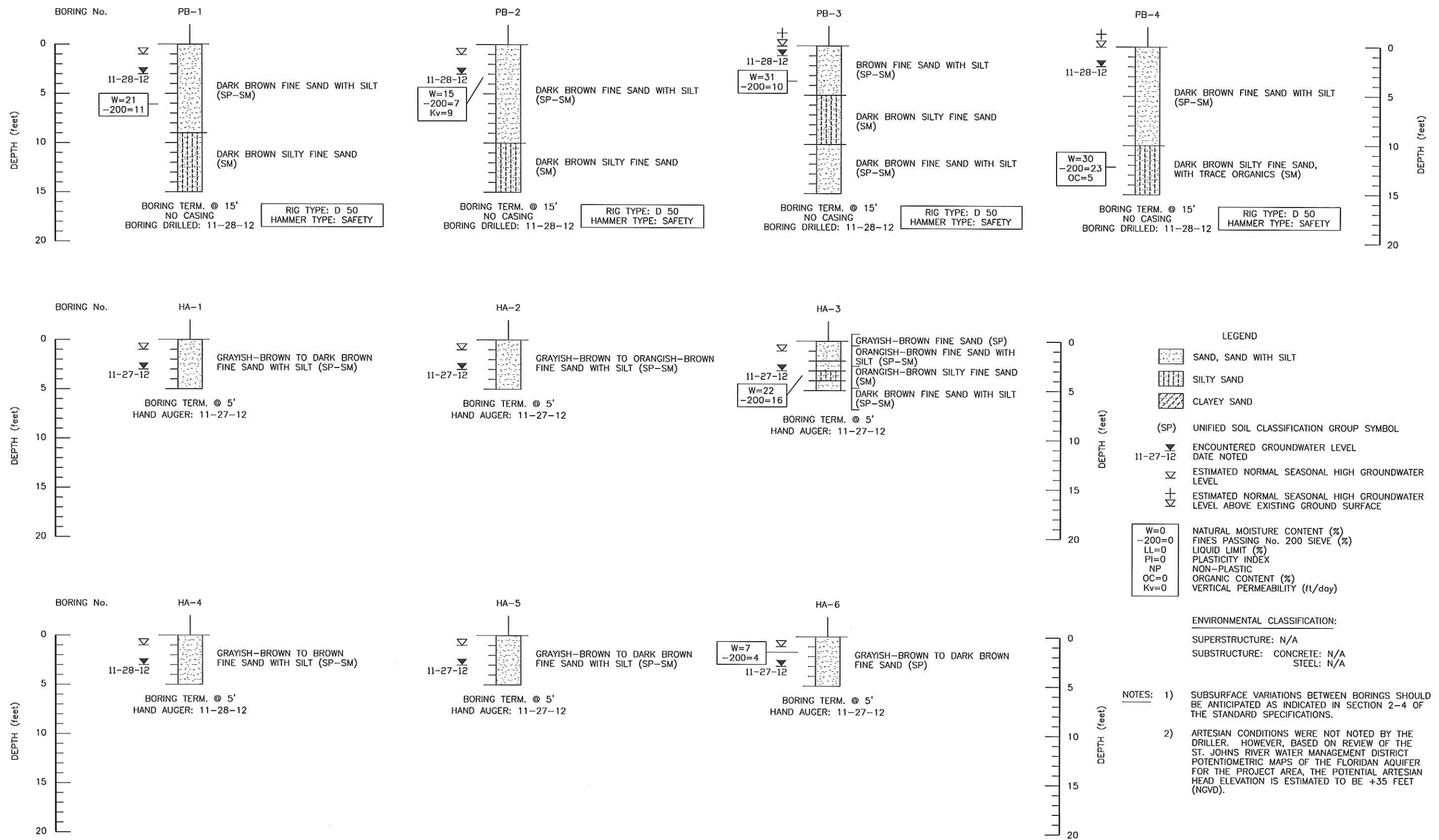
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SR-	ORANGE	-

**REPORT OF BORINGS**

PROJECT NAME: **PROPOSED THREE POINTS MAINTENANCE FACILITY**

REF. DWG. NO.   
 SHEET NO.   
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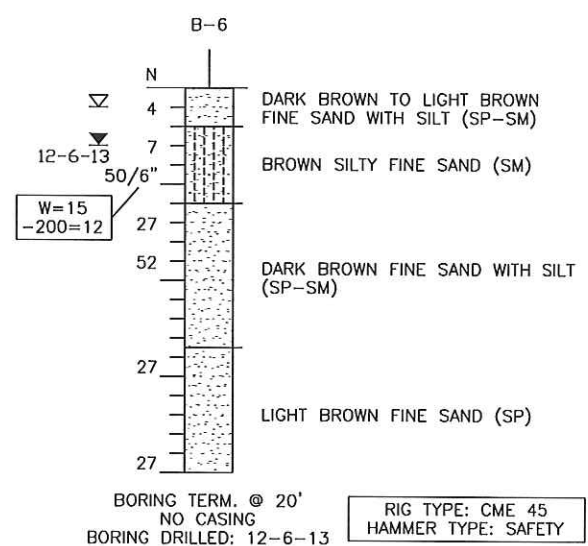
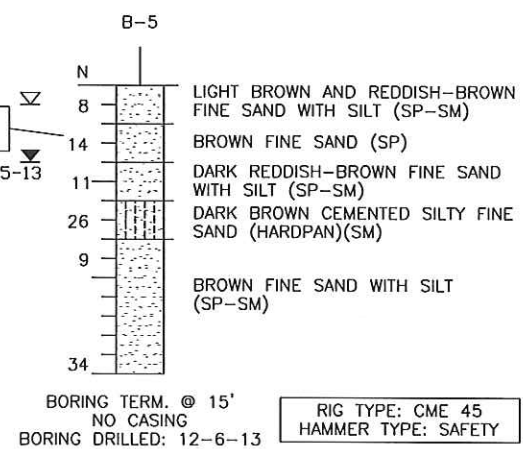
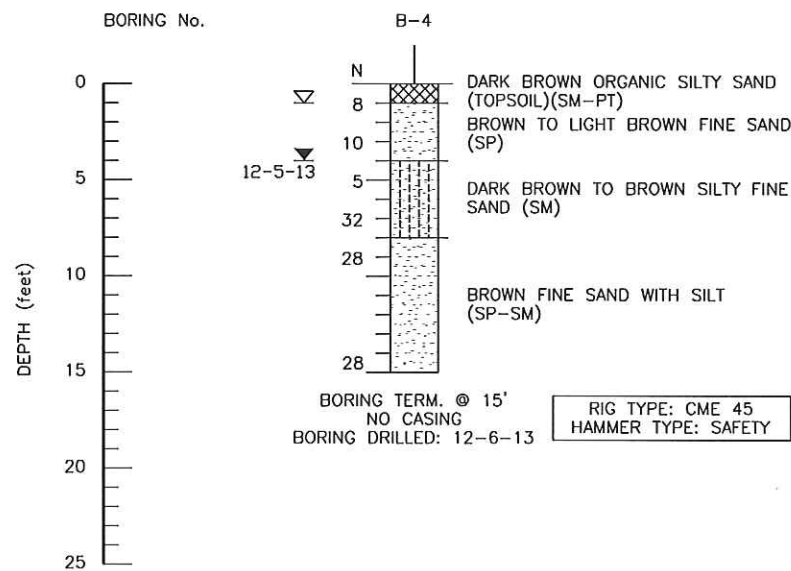
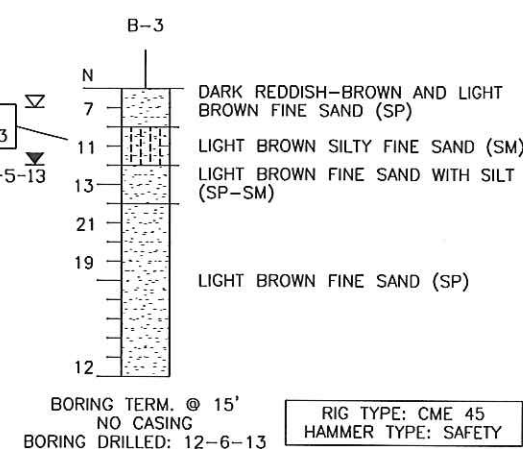
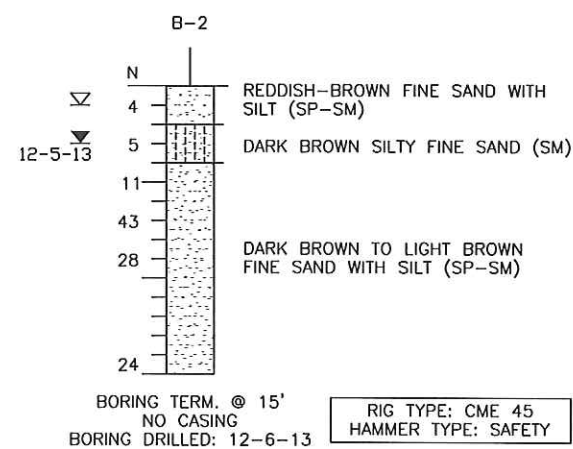
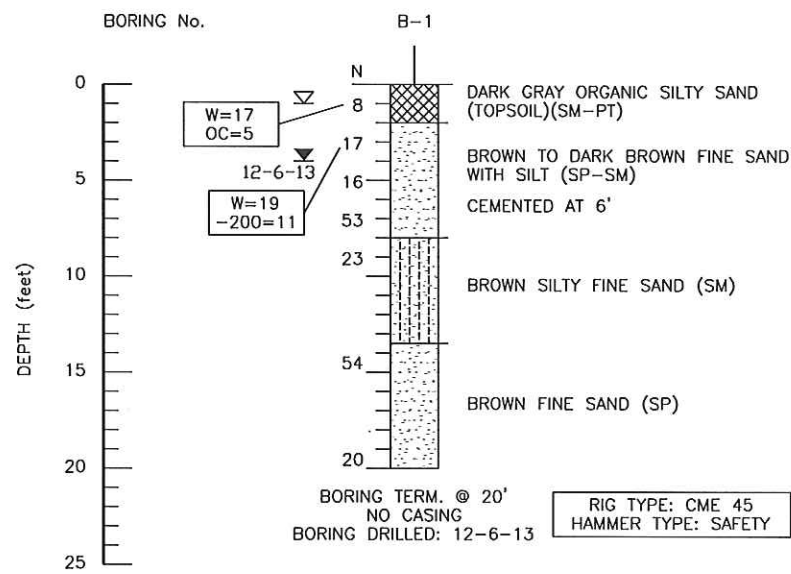
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Joint Venture**

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ROAD NO.	COUNTY	FINANCIAL PROJECT ID	
SR--	ORANGE	--	

SHEET TITLE:	<b>REPORT OF BORINGS</b>		REF. DWG. NO.
PROJECT NAME:	<b>PROPOSED THREE POINTS MAINTENANCE FACILITY</b>		SHEET NO.



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**LEGEND**

	SAND, SAND WITH SILT
	SILTY SAND
	ORGANIC SAND, SILTY SAND (TOPSOIL)
(SP)	UNIFIED SOIL CLASSIFICATION GROUP SYMBOL
	ENCOUNTERED GROUNDWATER LEVEL
12-6-13	DATE NOTED
	ESTIMATED NORMAL SEASONAL HIGH GROUNDWATER LEVEL
	ESTIMATED NORMAL SEASONAL HIGH GROUNDWATER LEVEL ABOVE EXISTING GROUND SURFACE
W=0	NATURAL MOISTURE CONTENT (%)
-200=0	FINES PASSING No. 200 SIEVE (%)
LL=0	LIQUID LIMIT (%)
Pl=0	PLASTICITY INDEX
NP	NON-PLASTIC
OC=0	ORGANIC CONTENT (%)
N	STANDARD PENETRATION RESISTANCE IN BLOWS PER FOOT

**STANDARD PENETRATION TEST DATA**

SPOON INSIDE DIA.	1 3/8 in.
SPOON OUTSIDE DIA.	2 in.
ASTM STANDARD DROP SAFETY HAMMER (ROPE-CATHEAD)	
AVG. HAMMER DROP	30 in.
HAMMER WEIGHT	140 lbs.

**GRANULAR MATERIALS**

RELATIVE DENSITY	SPT (BLOWS/FOOT)
VERY LOOSE	LESS THAN 4
LOOSE	4-10
MEDIUM DENSE	10-30
DENSE	30-50
VERY DENSE	GREATER THAN 50

**SILTS AND CLAYS**

CONSISTENCY	SPT (BLOWS/FOOT)
VERY SOFT	LESS THAN 2
SOFT	2-4
FIRM	4-8
STIFF	8-15
VERY STIFF	15-30
HARD	GREATER THAN 30

**ENVIRONMENTAL CLASSIFICATION:**

SUPERSTRUCTURE: N/A

SUBSTRUCTURE: CONCRETE: N/A  
STEEL: N/A

- NOTES:**
- SUBSURFACE VARIATIONS BETWEEN BORINGS SHOULD BE ANTICIPATED AS INDICATED IN SECTION 2-4 OF THE STANDARD SPECIFICATIONS.
  - ARTESIAN CONDITIONS WERE NOT NOTED BY THE DRILLER. HOWEVER, BASED ON REVIEW OF THE ST. JOHNS RIVER WATER MANAGEMENT DISTRICT POTENTIOMETRIC MAPS OF THE FLORIDAN AQUIFER FOR THE PROJECT AREA, THE POTENTIAL ARTESIAN HEAD ELEVATION IS ESTIMATED TO BE +35 FEET (NGVD).

**REVISIONS**

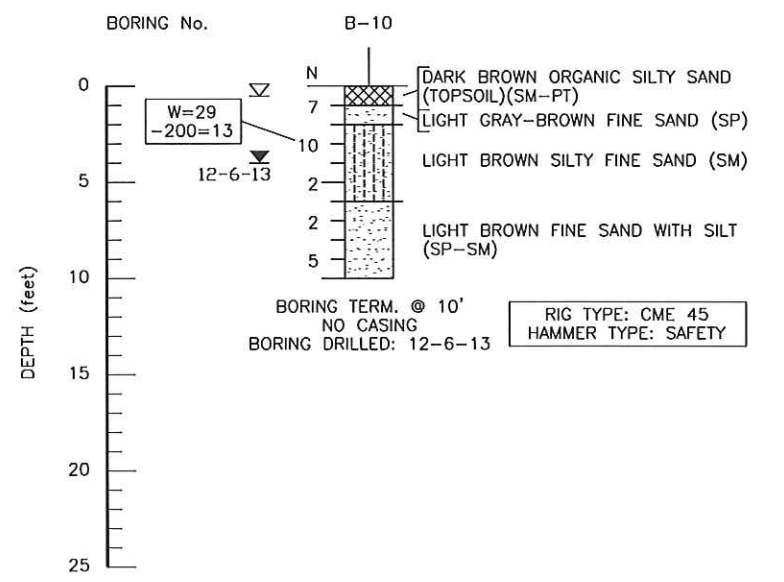
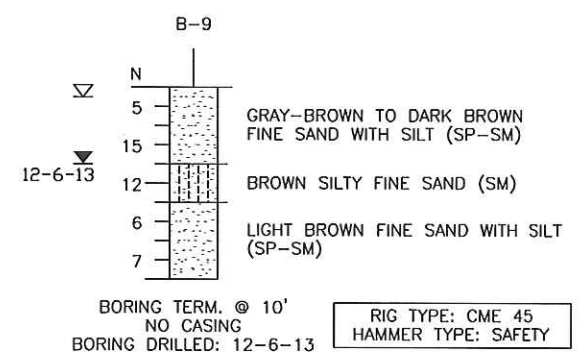
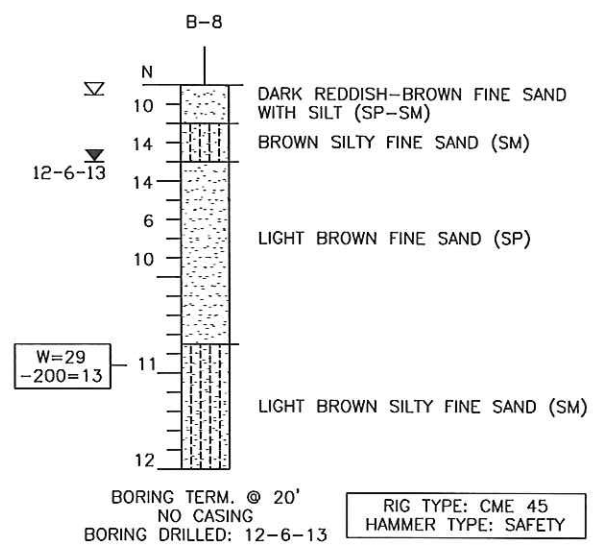
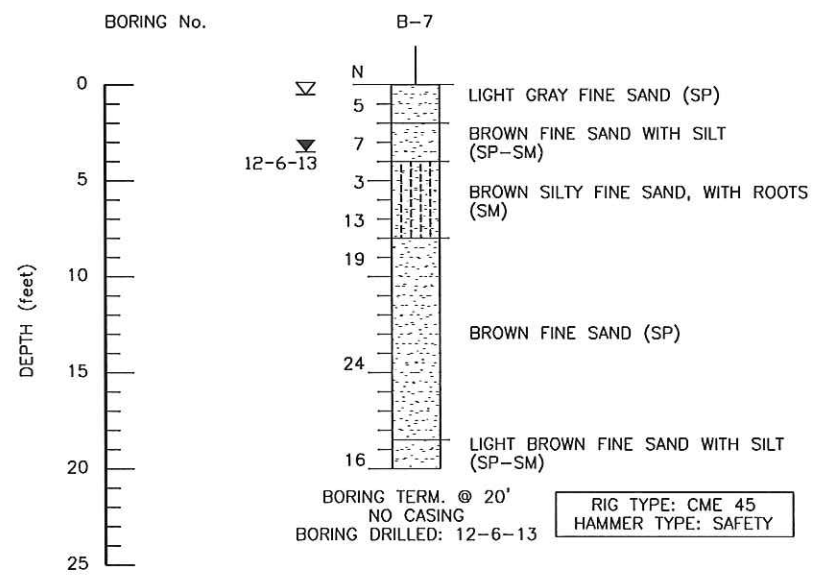
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Joint Venture**

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CHECKED BY:			

SHEET TITLE: <b>REPORT OF BORINGS</b>	REF. DWG. NO.
PROJECT NAME: <b>THREE POINTS MAINTENANCE FACILITY</b>	SHEET NO. -

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**LEGEND**

- SAND, SAND WITH SILT
- SILTY SAND
- ORGANIC SAND, SILTY SAND (TOPSOIL)
- (SP) UNIFIED SOIL CLASSIFICATION GROUP SYMBOL
- ▼ ENCOUNTERED GROUNDWATER LEVEL DATE NOTED
- ▽ ESTIMATED NORMAL SEASONAL HIGH GROUNDWATER LEVEL
- ± ESTIMATED NORMAL SEASONAL HIGH GROUNDWATER LEVEL ABOVE EXISTING GROUND SURFACE

W=0  
-200=0  
LL=0  
Pl=0  
NP  
OC=0

N STANDARD PENETRATION RESISTANCE IN BLOWS PER FOOT

**STANDARD PENETRATION TEST DATA**

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**ENVIRONMENTAL CLASSIFICATION:**

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STEEL: N/A

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SHEET TITLE: <b>REPORT OF BORINGS</b>	REF. DWG. NO.
PROJECT NAME: <b>THREE POINTS MAINTENANCE FACILITY</b>	SHEET NO. -

## **SECTION 02110 - SITE CLEARING**

### **PART 1. GENERAL**

#### **1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of Contract apply to work of this Section.

#### **1.2 DESCRIPTION OF WORK**

- A. Extent of site clearing is shown on drawings.
- B. Site clearing work includes, but is not limited to:
1. Protection of existing trees.
  2. Removal of trees and other vegetation.
  3. Topsoil stripping.
  4. Clearing and grubbing.
  5. Removing above-grade improvements.
  6. Removing below-grade improvements: disconnect and cap utility services.

#### **1.3 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 protections necessary to prevent damage to existing improvements indicated to remain in place.
1. Protect improvements on adjoining properties and on Owner's property.
  2. Restore damaged improvements to their original condition, as acceptable to parties having jurisdiction.
- C. Protection of Existing Trees and Vegetation: Protect existing trees and other vegetation indicated to remain in place, against unnecessary cutting, breaking or skinning of roots, skinning and bruising of bark, smothering of trees by stockpiling construction materials or excavated materials within drip line, excess foot or vehicular traffic, or parking of vehicles within drip line. Provide temporary guards to protect trees and vegetation to be left standing.
1. Water trees and other vegetation to remain within limits of the contract work as required to maintain their health during course of construction operations.
  2. Provide protection for roots over 1-1/2 inches in diameter cut during construction operations. Coat cut faces with an emulsified asphalt, or other acceptable coating, formulated for use on damaged plant tissues. Temporarily cover exposed roots with wet burlap to prevent roots from drying out; cover with earth as soon as possible.

3. Repair or replace trees and vegetation indicated to remain which are damaged by construction operations, in a manner acceptable to Engineer. Employ licensed arborist to repair damages to trees and shrubs.
  4. Replace trees which cannot be repaired and restored to full- growth status, as determined by arborist.
- D. Improvements on Adjoining Property: Authority for performing removal and alteration work on property adjoining Owner's property will be obtained by Owner prior to award of contract.
1. Extent of work on adjacent property is indicated on Drawings.
- E. Salvable Improvements: Carefully remove items indicated to be salvaged, and store on Owner's premises where indicated or directed.

## PART 2. PRODUCTS (Not applicable.)

## PART 3. EXECUTION

### 3.1 SITE CLEARING

- A. General: Remove trees, shrubs, grass and other vegetation, improvements, or obstructions interfering with installation of new construction. Remove such items elsewhere on site or premises as specifically indicated. Removal includes digging out stumps and roots.
1. Carefully and cleanly cut roots and branches of trees indicated to be left standing, where such roots and branches obstruct new construction.
- B. Topsoil: Topsoil is defined as surface soil found in a depth of not less than 4 inches. Satisfactory topsoil is reasonably free of subsoil, clay lumps, stones, and other objects over 2 inches in diameter, and without weeds, roots, and other objectionable material.
1. Strip topsoil to whatever depths encountered in a manner to prevent intermingling with underlying subsoil or other objectionable material.
    - a. Remove heavy growths of grass from areas before stripping.
    - b. Where trees are indicated to be left standing, stop topsoil stripping a sufficient distance to prevent damage to main root system.
  2. 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 wind-blown dust.
  3. Dispose of unsuitable or excess topsoil same as waste material, herein specified.
- C. Clearing and Grubbing: Clear site of trees, shrubs and other vegetation, except for those indicated to be left standing.
1. Completely remove stumps, roots, and other debris protruding through ground surface.
  2. Use only hand methods for grubbing inside drip line of trees indicated to be left standing.
  3. Fill depressions caused by clearing and grubbing operations with satisfactory soil material, unless further excavation or earthwork is indicated.

- a. Place fill material in horizontal layers not exceeding 6" loose depth, and thoroughly compact to a density equal to adjacent original ground.
- D. Removal of Improvements: Remove existing above-grade and below-grade improvements necessary to permit construction, and other work as indicated.
  - 1. Abandonment or removal of certain underground pipe or conduits may be shown on mechanical or electrical drawings, and is included under work of those sections. Removal of abandoned underground piping or conduit interfering with construction is included under this section.
  - 2. Contact local utility companies 48 hours minimum prior to start of demolition work. Confirm verbal and written notices. Verify locations of all utilities entering site and their location on the site.
  - 3. Cooperate with owner, utility companies, adjacent property owners, and other building trades in maintaining, protecting, rerouting or extending of utilities passing through work areas which serve structures located on project site and on adjacent properties.
  - 4. Verify which utilities are to be removed, capped or abandoned are turned off, or are disconnected, or are rerouted to new locations before starting demolition.

### 3.2 DISPOSAL OF WASTE MATERIALS

- A. Burning on Owner's Property: Burning is not permitted on Owner's property.
- B. Removal from Owner's Property: Remove waste materials and unsuitable, excess topsoil off site in legal manner.

END OF SECTION



## **SECTION 02200 - EARTHWORK**

### **PART 1. GENERAL**

#### **1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of Contract apply to work of this Section.

#### **1.2 SUMMARY**

- A. This Section includes the following:
1. Preparing of subgrade for building slabs, walks, and structures.
  2. For preparation of pavement subgrade.
  3. Excavating and backfilling of trenches within building lines.
  4. For pavement subgrade stabilization and base, refer to other Division 2 sections.
- B. Excavating and Backfilling of Utility Trenches: Refer to Earthwork - Underground Utilities, Section 02210.
- C. Final Grading, together with placement and preparation of topsoil for lawns and planting, is specified in Division 2 Section, "Landscape Work."

#### **1.3 DEFINITIONS**

- A. Excavation consists of removal of material encountered to subgrade elevations indicated and subsequent disposal of materials removed.
- B. Unauthorized excavation consists of removal of materials beyond indicated subgrade elevations or dimensions without specific direction of Engineer. Unauthorized excavation, as well as remedial work directed by Engineer, shall be at Contractor's expense.
1. Under footings, foundation bases, or retaining walls, fill unauthorized excavation by extending indicated bottom elevation of footing or base to excavation bottom, without altering required top elevation. Lean concrete fill may be used to bring elevations to proper position, when acceptable to Engineer.
  2. In locations other than those above, backfill and compact unauthorized excavations as specified for authorized excavations of same classification, unless otherwise directed by Engineer.
- C. Additional Excavation: When excavation has reached required subgrade elevations, notify Engineer, who will make an inspection of conditions. If Engineer determines that bearing materials at required subgrade elevations are unsuitable, continue excavation until suitable bearing materials are encountered and replace excavated material as directed by Engineer. The Contract Sum may be adjusted by an appropriate Contract Modification.

1. Removal of unsuitable material and its replacement as directed will be paid on basis of Conditions of the Contract relative to changes in work.
- D. Subgrade: The undisturbed earth or the compacted soil layer immediately below granular subbase, drainage fill, or topsoil materials.
- E. Structure: Buildings, foundations, slabs, tanks, curbs, or other man-made stationary features occurring above or below ground surface.

#### 1.4 SUBMITTALS

- A. Test Reports: Submit the following reports directly to Engineer from the testing services, with copy to Contractor:
  1. Test reports on borrow material.
  2. Verification of suitability of each footing subgrade material, in accordance with specified requirements.
  3. Field reports; in-place soil density tests.
  4. One optimum moisture-maximum density curve for each type of soil encountered.
  5. Report of actual unconfined compressive strength and/or results of bearing tests of each strata tested.

#### 1.5 QUALITY ASSURANCE

- A. Codes and Standards: Perform excavation work in compliance with applicable requirements of authorities having jurisdiction.
- B. Testing and Inspection Service: Owner will employ and pay for a qualified independent geotechnical testing laboratory to perform soil testing and inspection service during earthwork operations.
- C. Testing Laboratory Qualifications: To qualify for acceptance, the geotechnical testing laboratory must demonstrate to Engineer's satisfaction, based on evaluation of laboratory-submitted criteria conforming to ASTM E 699, that it has the experience and capability to conduct required field and laboratory geotechnical testing without delaying the progress of the Work.

#### 1.6 PROJECT CONDITIONS

- A. Site Information: Data in subsurface investigation reports was used for the basis of the design and are provided at the end of this specification section to the Contractor for information only. Conditions are not intended as representations or warranties of accuracy or continuity between soil borings. The Owner will not be responsible for interpretations or conclusions drawn from this data by Contractor.
  1. Additional test borings and other exploratory operations may be performed by Contractor, at the Contractor's option; however, no change in the Contract Sum will be authorized for such additional exploration.

- B. Existing Utilities: Locate existing underground utilities in areas of excavation work. If utilities are indicated to remain in place, provide adequate means of support and protection during earthwork operations.
  - 1. Should uncharted, or incorrectly charted, piping or other utilities be encountered during excavation, consult utility owner immediately for directions. Cooperate with Owner and utility companies in keeping respective services and facilities in operation. Repair damaged utilities to satisfaction of utility owner.
    - a. Provide minimum of 48-hour notice to Engineer, and receive written notice to proceed before interrupting any utility.
  - 2. Demolish and completely remove from site existing underground utilities indicated to be removed. Coordinate with utility companies and Owner for shutoff of services if lines are active.
- C. Use of Explosives: Use of explosives is not permitted.
- D. Protection of Persons and Property: Barricade open excavations occurring as part of this work and post with warning lights.
  - 1. Operate warning lights as recommended by authorities having jurisdiction.
  - 2. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.
  - 3. Perform excavation by hand within dripline of large trees to remain. Protect root systems from damage or dryout to the greatest extent possible. Maintain moist condition for root system and cover exposed roots with moistened burlap.

## PART 2. PRODUCTS

### 2.1 SOIL MATERIALS

- A. Satisfactory soil materials are defined as those complying with ASTM D2487 soil classification groups GW, GP, GM, SM, SW, and SP.
- B. Unsatisfactory soil materials are defined as those complying with ASTM D2487 soil classification groups GC, SC, ML, MH, CL, CH, OL, OH, and PT.
- C. Backfill and Fill Materials: Satisfactory soil materials free of clay, rock or gravel larger than 2 inches in any dimension, debris, waste, frozen materials, vegetation and other deleterious matter.

## PART 3. EXECUTION

### 3.1 EXCAVATION

- A. Excavation is unclassified and includes excavation to subgrade elevations indicated, regardless of character of materials and obstructions encountered.

### 3.2 STABILITY OF EXCAVATIONS

- A. General: Comply with local codes, ordinances, and requirements of agencies having jurisdiction.
- B. Slope sides of excavations to comply with local codes, ordinances, and requirements of agencies having jurisdiction. Shore and brace where sloping is not possible because of space restrictions or stability of material excavated. Maintain sides and slopes of excavations in safe condition until completion of backfilling.
- C. Shoring and Bracing: Provide materials for shoring and bracing, such as sheet piling, uprights, stringers, and cross braces, in good serviceable condition. Maintain shoring and bracing in excavations regardless of time period excavations will be open. Extend shoring and bracing as excavation progresses.

### 3.3 DEWATERING

- A. Control of groundwater is required to achieve the necessary construction including earthwork, excavation, backfilling, placement of foundation and utilities. Contractor shall review the subsurface soil exploration provided for requirements of separation between bottom of any excavation or compaction surface and encountered groundwater table.
- B. Prevent surface water and subsurface or ground water from flowing into excavations and from flooding project site and surrounding area.
  - 1. Do not allow water to accumulate in excavations. Remove water to prevent softening of foundation bottoms, undercutting footings, and soil changes detrimental to stability of subgrades and foundations. Provide and maintain pumps, well points, sumps, suction and discharge lines, and other dewatering system components necessary to convey water away from excavations.
  - 2. Establish and maintain temporary drainage ditches and other diversions outside excavation limits to convey rain water and water removed from excavations to collecting or runoff areas. Do not use trench excavations as temporary drainage ditches.

### 3.4 STORAGE OF EXCAVATED MATERIALS

- C. Stockpile excavated materials acceptable for backfill and fill where directed. Place, grade, and shape stockpiles for proper drainage.
  - 1. Locate and retain soil materials away from edge of excavations. Do not store within drip line of trees indicated to remain.
  - 2. Dispose of excess excavated soil material and materials not acceptable for use as backfill or fill.

### 3.5 EXCAVATION FOR STRUCTURES

- A. Conform to elevations and dimensions shown within a tolerance of plus or minus 0.10 foot, and extending a sufficient distance from footings and foundations to permit placing and removal of concrete formwork, installation of services, and other construction and for inspection.
  - 1. Excavations for footings and foundations: Do not disturb bottom of excavation. Excavate by hand to final grade just before concrete reinforcement is placed. Trim bottoms to required lines and grades to leave solid base to receive other work.
  - 2. Excavation for Underground Tanks, Basins, and Mechanical or Electrical Structures: Conform to elevations and dimensions indicated within a tolerance of plus or minus 0.10 foot; plus a sufficient distance to permit placing and removal of concrete formwork, installation of services, and other construction and for inspection. Do not disturb bottom of excavations, intended for bearing surface.

### 3.6 EXCAVATION FOR PAVEMENTS

- A. Cut surface under pavements to comply with cross-sections, elevations and grades as indicated.

### 3.7 TRENCH EXCAVATION FOR PIPES AND CONDUIT

- A. Refer to Earthwork - Underground Utilities, Section 02210.

### 3.8 COLD WEATHER PROTECTION

- A. Protect excavation bottoms against freezing when atmospheric temperature is less than 35 degrees F.

### 3.9 BACKFILL AND FILL

- A. General: Place soil material in layers to required subgrade elevations, for each area classification listed below, using materials specified in Part 2 of this Section.
  - 1. Under grassed areas, use satisfactory excavated or borrow material.
  - 2. Under walks and pavements, use subbase material, satisfactory excavated or borrow material, or a combination.
  - 3. Under steps, use satisfactory excavated or borrow material.
  - 4. Under building slabs, use satisfactory excavated or borrow material.
  - 5. Backfill trenches with concrete where trench excavations pass within 18 inches of column or wall footings and that are carried below bottom of such footings or that pass under wall footings. Place concrete to level of bottom of adjacent footing.
    - a. Concrete is specified in Division 3.
    - b. Do not backfill trenches until tests and inspections have been made and backfilling is authorized by Engineer. Use care in backfilling to avoid damage or displacement of pipe systems.
  - 6. Provide 4-inch-thick concrete base slab support for piping or conduit less than 2'-6" below surface of roadways. After installation and testing of piping or conduit, provide minimum 4-inch-thick encasement (sides and top) of concrete prior to backfilling or placement of roadway subbase.

- B. Backfill excavations as promptly as work permits, but not until completion of the following:
1. Acceptance of construction below finish grade including, where applicable, dampproofing, waterproofing, and perimeter insulation.
  2. Inspection, testing, approval, and recording locations of underground utilities have been performed and recorded.
  3. Removal of concrete formwork.
  4. Removal of shoring and bracing, and backfilling of voids with satisfactory materials. Cut off temporary sheet piling driven below bottom of structures and remove in manner to prevent settlement of the structure or utilities, or leave in place if required.
  5. Removal of trash and debris from excavation.
  6. Permanent or temporary horizontal bracing is in place on horizontally supported walls.

### 3.10 PLACEMENT AND COMPACTION

- A. Ground Surface Preparation: Remove vegetation, debris, unsatisfactory soil materials, obstructions, and deleterious materials from ground surface prior to placement of fills. Plow strip, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so that fill material will bond with existing surface.
1. When existing ground surface has a density less than that specified under "Compaction" for particular area classification, break up ground surface, pulverize, moisture-condition to optimum moisture content, and compact to required depth and percentage of maximum density.
- B. Place backfill and fill materials in layers not more than 8 inches in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers.
- C. Before compaction, moisten or aerate each layer as necessary to provide optimum moisture content. Compact each layer to required percentage of maximum dry density or relative dry density for each area classification. Do not place backfill or fill material on surfaces that are muddy, frozen, or contain frost or ice.
- D. Place backfill and fill materials evenly adjacent to structures, piping, or conduit to required elevations. Prevent wedging action of backfill against structures or displacement of piping or conduit by carrying material uniformly around structure, piping, or conduit to approximately same elevation in each lift.
- E. Control soil and fill compaction, providing minimum percentage of density specified for each area classification indicated below. Correct improperly compacted areas or lifts as directed by Engineer if soil density tests indicate inadequate compaction.
1. Percentage of Maximum Density Requirements: Compact soil to not less than the following percentages of maximum density, in accordance with ASTM D 1557:
    - a. Under structures, building slabs and steps, and pavements, compact top 12 inches of subgrade and each layer of backfill or fill material at 98 percent maximum density.

- b. Under lawn or unpaved areas, compact top 6 inches of subgrade and each layer of backfill or fill material at 90 percent maximum density.
- c. Under walkways, compact top 6 inches of subgrade and each layer of backfill or fill material at 95 percent maximum density.
- 2. Moisture Control: Where subgrade or layer of soil material must be moisture conditioned before compaction, uniformly apply water to surface of subgrade or layer of soil material. Apply water in minimum quantity as necessary to prevent free water from appearing on surface during or subsequent to compaction operations.
  - a. Remove and replace, or scarify and air dry, soil material that is too wet to permit compaction to specified density.
  - b. Stockpile or spread soil material that has been removed because it is too wet to permit compaction. Assist drying by discing, harrowing, or pulverizing until moisture content is reduced to a satisfactory value.

### 3.11 GRADING

- A. General: Uniformly grade areas within limits of grading under this section, including adjacent transition areas. Smooth finished surface within specified tolerances, compact with uniform levels or slopes between points where elevations are indicated or between such points and existing grades.
- B. Grading Outside Building Lines: Grade areas adjacent to building lines to drain away from structures and to prevent ponding. Finish surfaces free from irregular surface changes and as follows:
  - 1. Lawn or Unpaved Areas: Finish areas to receive topsoil to within not more than 0.10 foot above or below required subgrade elevations.
  - 2. Walks: Shape surface of areas under walks to line, grade, and cross-section, with finish surface not more than 0.10 foot above or below required subgrade elevation.
  - 3. Pavements: Shape surface of areas under pavement to line, grade, and cross-section, with finish surface not more than 1/2 inch above or below required subgrade elevation.
- C. Grading Surface of Fill under Building Slabs: Grade smooth and even, free of voids, compacted as specified, and to required elevation. Provide final grades within a tolerance of 1/2 inch when tested with a 10-foot straightedge.
- D. Compaction: After grading, compact subgrade surfaces to the depth and indicated percentage of maximum or relative density for each area classification.

### 3.12 PAVEMENT SUBBASE COURSE

- A. Refer to other Division 2 sections for preparation of subgrade, subbase, base, and paving specifications.
- B. Grade Control: During construction, maintain lines and grades including crown and cross-slope of subbase course.

### 3.13 FIELD QUALITY CONTROL

- A. Quality Control Testing During Construction: Allow testing service to inspect and approve each subgrade and fill layer before further backfill or construction work is performed.
1. Perform field density tests in accordance with ASTM D 1556 (sand cone method) or AASHTO T-180 or ASTM D 2167 (rubber balloon method), as applicable.
    - a. Field density tests may also be performed by the nuclear method in accordance with ASTM D 2922, providing that calibration curves are periodically checked and adjusted to correlate to tests performed using ASTM D 1556. In conjunction with each density calibration check, check the calibration curves furnished with the moisture gages in accordance with ASTM D 3017.
    - b. If field tests are performed using nuclear methods, make calibration checks of both density and moisture gages at beginning of work, on each different type of material encountered, and at intervals as directed by the Engineer.
  2. Footing Subgrade: For each strata of soil on which footings will be placed, perform at least one test to verify required design bearing capacities. Subsequent verification and approval of each footing subgrade may be based on a visual comparison of each subgrade with related tested strata when acceptable to Engineer.
  3. Building Slab Subgrade: Perform at least one field density test of subgrade for every 2,000 sq. ft. of paved area or building slab, but in no case fewer than three tests. In each compacted fill layer, perform one field density test for every 2,000 sq. ft. of overlaying building slab or paved area, but in no case fewer than three tests.
  4. Foundation Wall Backfill: Perform at least two field density tests at locations and elevations as directed.
  5. Pavement Subgrade: One field density test for each compacted layer per 10,000 sq. ft. of paved area or 250 l.f. of roadways, but no fewer than three tests per paved area.
  6. If in opinion of Engineer, based on testing service reports and inspection, subgrade or fills that have been placed are below specified density, perform additional compaction and testing until specified density is obtained.

### 3.14 EROSION CONTROL

- A. Provide erosion control methods in accordance with requirements of authorities having jurisdiction.

### 3.15 MAINTENANCE

- A. Protection of Graded Areas: Protect newly graded areas from traffic and erosion. Keep free of trash and debris.
- B. Repair and reestablish grades in settled, eroded, and rutted areas to specified tolerances.
- C. Reconditioning Compacted Areas: Where completed compacted areas are disturbed by subsequent construction operations or adverse weather, scarify surface, reshape, and compact to required density prior to further construction.



- D.           Settling: Where settling is measurable or observable at excavated areas during general project warranty period, remove surface (pavement, lawn, or other finish), add backfill material, compact, and replace surface treatment. Restore appearance, quality, and condition of surface or finish to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

### 3.16 DISPOSAL OF EXCESS AND WASTE MATERIALS

- A.           Removal from Owner's Property: Remove waste materials, including unacceptable excavated material, trash, and debris, and dispose of it off Owner's property.

END OF SECTION

## SECTION 02210 - EARTHWORK - UNDERGROUND UTILITIES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, apply to work of this Section.

#### 1.2 DESCRIPTION OF WORK

- A. The work consists of excavating and backfilling all trenches and pits required for the installation of all underground utilities, pipelines, culverts, appurtenant structures and other items called for or reasonably implied in the Drawings to include sheeting and bracing, dewatering, supply and transport of fill materials, and disposal of waste materials. Appurtenant structures include headwalls, manholes, lift stations, box culverts, junction boxes, catch basins, inlets and other items related to underground systems.

### PART 2 - MATERIALS

- 2.1 Bedding Material - CLASS I: ASTM D 2321, except that sizing shall be 1/4 inch to 3/4 inch. (Angular graded stone, including a number of fill materials that have regional significance such as coral, slag, cinders, crushed stone, and crushed shells.)
- 2.2 Bedding Material - CLASS II: ASTM D 2321, except that upper size limit shall be 3/4 inch. (Coarse sands and gravels including variously graded sands and gravels containing small percentages of fines, generally granular and noncohesive, either wet or dry. Unified Soil Classification System (USCS) soil types GW, GP, SW, and SP are included.)
- 2.3 Bedding Material - CLASS III: ASTM D 2321. (Fine sand and clay gravels, including fine sands, sand-clay mixtures, and gravel-clay mixtures, USCS soil types GM, GC, SM, and SC are included.)
- 2.4 Initial Lift Backfill: Clean earth fill composed of sand, clay and sand, sand and rock, crushed rock, or approved combination. Under no circumstances shall any muck, stumps, roots, brush, trash, rubbish or organic material be used in the backfill. Material may be selected from the excavation, or obtained, if necessary, from an approved borrow pit area. The fragment size listed below shall not be exceeded for the following pipe materials.

#### Fragment Size

A. Pipe Material	(Greatest Dimension - Inches)
Concrete	3
Steel	3

Cast Iron	3
Ductile Iron	3
Corrugated Metal	3
Vitrified Clay	1-1/2
Plastic	1
Asbestos Cement	1/2

- 2.5 Final Lift Backfill: As described in the above paragraph, Initial Lift Backfill, except that maximum dimension for any stone or pavement fragment shall be 6 inches.
- 2.6 Sheeting and Bracing: Wood sheeting to be left in place shall be treated with preservatives per FDOT 955.

### PART 3 - EXECUTION

- 3.1 General: Trenches shall be excavated to the alignment and elevations required to install utilities with proper foundations and bedding. Open no more trench in advance of pipe laying than is necessary to expedite the work.
- 3.2 Sheeting and Bracing: To prevent damage to property, injury to erosion, cave-ins, or excessive trench widths, or as required by law, adequate sheeting and bracing shall be provided. Sheeting shall be removed when the trench has been backfilled to at least one-half its depth, or when removal would not endanger the construction of adjacent structures. When required, to eliminate excessive trench width or other damage, sheeting, bracing or shoring shall be left in place and the top cut off at an elevation 2.5' below finished grade, unless otherwise specified. Wood sheeting shall not be removed from the trench region below the crown of the pipe.
- 3.3 Trench Width: The minimum width of the trench shall be equal to the outside diameter of the pipe at the joint plus 8 inches for unsheeted trench, or 12 inches for sheeted trench. Trench walls shall be maintained as vertical as possible to the top of the pipes; the maximum width of trench measured at the top of the pipe shall not exceed the outside pipe diameter plus 2', unless otherwise called for in the Drawings.
- 3.4 Unstable Trench/Pit Bottom: Where muck or other deleterious materials are encountered at or below trench grade, they shall be removed and replaced with Bedding Material in layers not to exceed 6 inches in thickness, compacted to at least 95% of maximum (AASHTO T-180) density. The Engineer may elect, depending upon the severity of the unstable soil, to require special foundations.
- 3.5 Over-Excavation: Should the trench be inadvertently over-excavated below a point 6 inches below the bottom of the pipe, but not beyond a point 12 inches below the bottom of the pipe, fill that area of over-excavation with Bedding Material and compact to 95% of maximum (AASHTO T-180) density. Contractor shall fill any area of over-excavation beyond a point 12 inches below the bottom of the pipe with Class I Bedding material to form an impervious mat at his expense. Where the Engineer approves alternate material, compaction shall be not less than 95% of maximum (AASHTO T-180) density.

- 3.6 Noncushioned Trench Bottom: Where pipe is to be laid in a rock-cut or other noncushioned material, excavation shall allow for 6 inches of bedding beneath the pipe.
- 3.7 Excavated Materials: Ownership of all suitable excavated materials shall remain with the Owner until the final job requirement for fill or backfill materials have been fulfilled. Unless otherwise provided, any surplus materials then remaining and not needed for job requirements shall become the property of Contractor and are to be disposed of by him. Excavated material to be used for backfill shall be neatly and safely deposited at the sides of the trench/pit where space is available. All excavated material shall be stockpiled in a manner that will not endanger the work. Hydrants under pressure, water and gas valves, manhole covers, fire and police call boxes, or other utility controls shall be left unobstructed and accessible. Gutters shall be kept open or other satisfactory provisions made for street drainage, and natural water courses shall not be obstructed. Unless otherwise approved, stockpiles shall not obstruct adjacent streets, walks or driveways. Temporary store of apparent excess suitable materials in areas provided by Owner until such materials are needed in the job or are declared surplus. With the written approval of the Engineer, Contractor may dispose of such apparent excess material with the stipulation that he shall replace any portion of the disposed material required to fulfill the actual job requirements, with equally suitable material, at his own expense.
- 3.8 Dewatering: All utilities and structures shall be laid/placed, "in the dry". Dewatering shall be by well-point unless otherwise approved by the Engineer. Dewatering shall be in accordance with good standard practice and all applicable codes and regulations and must be efficient enough to lower the water level in advance of the excavation and maintain the trench or pit bottom and sides continuously firm and dry through inspection. Discharge from dewatering shall not interfere with the normal drainage of the area in which the work is being performed, create a public nuisance or form ponding.
- 3.9 Bedding: All pipe shall be bedded Class B except where Class A is called for by the Engineer. Bedding shall be in accordance with the Standard Detail Drawings and as described herein.
- A. Class B: Raise trench to above pipe grade by placement and compaction of 4 inches to 6 inches of the bedding material specified for the particular system of installation. Provide bell holes to allow continuous support along the pipe barrel. Place and compact maximum (AASHTO T-180) density to the spring line of the pipe. Where coarse materials with voids have been used for bedding, the same coarse material shall also be used for the zone up to the spring line. Avoid vertical and lateral displacement of the pipe from proper alignment.
- 3.10 Backfill-Initial Lift: Initial Lift Backfill Material, as referenced in the "Initial Lift Backfill" paragraph above, shall be carefully placed and tamped over the upper half of the utility, and shall be carefully continued in layers not exceeding 6 inches in thickness for the full trench width, until the fill is 12 inches above the utility. Available material from the excavation shall be used if approved. The "Initial Lift" shall be thoroughly compacted and completed before the "Final Lift" is placed. Compact to 95% of maximum (AASHTO T-180) density.

- 3.11 Backfill-Final Lift: The remainder of the trench shall be backfilled with Final Lift Backfill material, as referenced in the "Final Lift Backfill" paragraph above, in layers not exceeding 12 inches. When trenches are cut in pavements or areas to be paved, compaction shall equal 98% of maximum (AASHTO T-180) density. Otherwise, compact to 95%.
- 3.12 Borrow: Should there be insufficient satisfactory material from the excavation to meet the requirements for fill material, and where borrow sites are not provided in the Contract Documents, borrow sites shall be secured by Contractor.
- 3.13 Compaction Method: The above specified compaction shall be accomplished using accepted standard methods (powered tampers, vibrators, etc.), with the exception that the first two feet of backfilling over the pipe shall be compacted by manual tamping devices. Flooding or puddling with water to consolidate backfill is not acceptable, except where sand is encountered.
- 3.14 Material Disposal: Excess, unsuitable, or cleared and grubbed material, resulting from the utility installation, shall be immediately removed from the work site and disposed of. Excess excavated material shall be spread on the disposal site and graded in a manner to drain properly and not disturb existing drainage conditions. Where disposal areas are not provided in the Contract Documents, Contractor shall furnish the disposal area without additional compensation.
- 3.15 Testing: Provide density testing by a qualified independent laboratory at intervals not to exceed 250 feet.

END OF SECTION

## **SECTION 02214 - PAVEMENT REMOVAL AND REPLACEMENT**

### **PART 1 - GENERAL**

#### **1.1 WORK INCLUDED**

- A. Work included under this Section consists of cutting, removing, protecting and replacing existing pavements.
- B. Permits: The Contractor shall obtain the necessary permits (Seminole County, "Right-of-Way Utilization Permit", State of Florida, Department of Transportation, "Utility Permit"; and other applicable authorization), prior to any roadway work. Additionally, the Contractor shall provide advance notice to the appropriate authority, as required, prior to construction operations.
- C. Protection of existing improvements: The Contractor shall be responsible for the protection of all pavements, and other improvements within the work area. All damage to such improvements, as a result of the Contractor's operations, beyond the limits of the work of pavement replacement as described herein, shall be repaired by the Contractor at his expense.

#### **1.2 JURISDICTIONAL REQUIREMENTS**

- A. Work within the rights-of-way of public thoroughfares which are not under jurisdiction of Seminole County, shall conform to the requirements of the Governmental agency having jurisdiction. Specifically, work within state highway right-of-way shall be in full compliance with all requirements of the permit drawings, and to the satisfaction of the Florida Department of Transportation.
- B. Portions of the Standard Specifications for Road and Bridge Construction of the Florida Department of Transportation, 1977, and Supplement thereto hereinafter referred to as the DOT Specifications, are referred to herein and amended, in part, and the same are hereby made a part of this Contract to the extent of such references, and shall be as binding upon the Contract as though reproduced herein in their entirety.

### **PART 2 - PRODUCTS**

#### **2.1 MATERIALS**

- A. Street or roadway pavement cut and removed in connection with trench excavation shall be replaced or restored in equal or better condition than the original and as shown on the Drawings. The Drawings indicate minimum requirements.

- B. Materials, including soil cement, bituminous prime and tack coat, and asphaltic concrete for the above work shall meet the requirements established therefore by the DOT Specifications.
1. Soil cement.
  2. Bituminous prime coat material shall be cutback asphalt Grade RC-70.
  3. Bituminous tack coat material shall be emulsified asphalt Grade RS-2.
  4. Asphaltic concrete shall be Type S-III.

### PART 3 - EXECUTION

#### 3.1 PERFORMANCE

A. Removals:

1. Pavement removal:
  - a. Where existing pavement is to be removed, the surfacing shall be mechanical saw cut prior to trench excavation, leaving a uniform and straight edge, with minimum disturbance to the remaining adjacent surfacing. The width of cut for this phase of existing pavement removal shall be minimal.
  - b. Immediately following the specified backfilling and compaction, a temporary sand seal coat surface shall be applied to the cut areas. This temporary surfacing shall provide a smooth traffic surface with the existing roadway and shall be maintained until final restoration. Said surfacing shall remain for 10 days in order to assure the stability of the backfill under normal traffic conditions. Following this period and prior to 15 days after application, the temporary surfacing shall be removed and final roadway surface restoration accomplished.
  - c. In advance of final restoration, the temporary surfacing shall be removed and the existing pavement mechanically sawed straight and clean to the stipulated dimensions. Following the above operation, the Contractor shall proceed immediately with final pavement restoration in accordance with the requirements set forth in the Seminole County, "Right-of-Way Utilization Regulations", and these standards.

B. Restorations:

1. Pavement restoration - asphalt:
  - a. Soil cement base course shall be compacted for its full thickness to not less than 95 percent of maximum density as determined by AASHTO Designation T-180. Field density of soil cement base in place shall be determined by AASHTO Designation T-191 or ASTM Designation D2922.
  - b. Construction methods and equipment shall generally meet the requirements therefore as established in the DOT Specifications, but shall be modified to meet the relatively narrow strip construction conditions. Any such modifications shall be approved by the Engineer prior to their use.

- c. After the application of the prime coat on the base, the prime coat shall be allowed to cure without sanding for a period of 24-hours. The Contractor shall take all necessary precautions to protect the primed surface against damage during this interval. If, at the end of 24-hours, it is not proposed to proceed at once with the application of the surface course, primed surface shall be given a light application of clean sand and opened to traffic.
- d. Joints with existing surface and base shall be straight and neat. If necessary to obtain a straight net joint, the Contractor shall cut out sufficient existing material and replace it with new material.

END OF SECTION



## **SECTION 02270 - EROSION AND SEDIMENTATION**

### **PART 1 - GENERAL**

#### **1.1 DESCRIPTION**

- A. All erosion, sedimentation and water pollution control features shall be in place or relocated as designated on the plans prior to the start of any clearing, grubbing, grading or construction. Contractor shall be responsible for the installation and maintenance of all temporary erosion control features.
- B. Location of the control features shall be in accordance with the Drawings or as required to facilitate drainage and control erosion and sedimentation within and adjacent to the site.
- C. Control features are defined as, but not limited to, swales, berms, silt fences, silt barriers and temporary fences.

#### **1.2 QUALITY ASSURANCE**

- A. The provision for prevention, control and abatement of erosion, sedimentation and water pollution shall be as stated in the Florida Department of Transportation Standard Specifications for Road and Bridge Construction, Section 104, latest edition.

#### **1.3 SUBMITTALS**

- A. Product data: Manufacturers literature, application instructions and samples.
- B. List of materials and their characteristics for other erosion control items.

#### **1.4 CONTROL OF CONTRACTOR'S OPERATIONS WHICH MAY RESULT IN WATER POLLUTION**

- A. Take sufficient precautions to prevent pollution of streams, canals, lakes, reservoirs, wetlands and other sensitive areas with silt, sediment, fuels, oils, bitumens, calcium chloride, or other harmful materials. Conduct and schedule operations so as to avoid or otherwise minimize pollution or siltation of such streams, etc. and to avoid interference with movement of migratory fish. Do not dump the residue from dust collectors or washers into any water body.
- B. Construction operations in rivers, streams, lakes, tidal waters, reservoirs, canals, and other impoundments shall be restricted to those areas where it is necessary to

perform filling or excavation to accomplish the work shown in the Contract Documents and to those areas which must be entered to construct temporary or permanent structures. As soon as conditions permit, promptly clear rivers, streams, and impoundments of all obstructions placed therein or caused by construction operations.

- C. Except as necessary for construction, do not deposit excavated material in rivers, streams, canals, or impoundments, or in a position close enough thereto, to be washed away by high water or run-off.
- D. Where pumps are used to remove highly turbid waters from enclosed construction areas such as cofferdams or forms, treat the water prior to discharge into State waters. Pump the water into grassed swales, appropriately vegetated areas, or sediment basins, or confine it by an appropriate enclosure such as siltation curtains when other methods are not considered appropriate. Do not contaminate State waters. The background condition of all waters to be discharged from the site must be tested prior to discharge. All waters discharged from the site must be approved through Orange County Environmental Department by the Engineer.
- E. Do not disturb lands or waters outside the limits of construction, unless approved in advance and in writing by the Owner. No operations within non-permitted wetlands or upland buffers are allowed.

#### 1.5 START OF WORK

- A. Do not start work until erosion control measures are in place.

### PART 2 - PRODUCTS

#### 2.1 MATERIALS

- A. Silt Barriers:
  - 1. Two types of silt barriers shall be installed in accordance with the plans: silt barriers installed on the ground and floating silt barriers.
  - 2. Silt barriers (filter fabric) shall be synthetic and contain ultraviolet ray inhibitors and stabilizers to provide a minimum of six (6) months of expected usable construction life at a temperature range of 0 to 120EF.
  - 3. Filter fabric shall be a pervious sheet of propylene, nylon or polyester and shall be certified by the manufacturer or supplier to conform to the following specifications:
    - Filter efficiency (Test VTM-51): 75%.
    - Minimum tensile strength at 20% elongation (Test ASTM-D-1682): 120 lbs.
    - Tear strength (Test ASTM D2263): 50 lbs.
  - 4. Contractor shall submit further filter fabric material specifications and installation configuration prior to start of construction.
  - 5. Silt barriers shall be maintained in place.

6. Filter fabric shall be purchased in a continuous roll cut to the length of the barrier to avoid the use of joints. When joints are necessary, filter fabric shall be spliced together only at a support post, with a 6 inch overlap, and securely sealed.
  7. The following items shall be installed and maintained in accordance with the applicable sections of the FDOT Standard Specifications:
    - a. Temporary silt fences and staked silt barriers
    - b. Floating silt barrier
- B. Temporary Fence
1. Brightly colored fence as manufactured by Mirafi, product Mirasafe, or approved equal.
  2. Material shall be 4' high, attached to 6' metal posts at 12' centers. Posts shall be driven 18" into ground.

### PART 3 - EXECUTION

#### 3.1 GENERAL

- A. Temporary erosion control features shall consist of, but not be limited to, temporary grassing, temporary sodding, temporary mulching, sandbagging, slope drains, sediment basins, artificial coverings, berms, baled hay or straw, floating silt barriers, staked silt barriers and staked silt fences. Design details for some of these items may be found in the Water Quality Section of the applicable edition of the FDOT Roadway and Traffic Design Standards. All of these items shall be constructed in accordance with applicable sections of the FDOT Standard Specifications.
- B. Incorporate permanent erosion control features into the project at the earliest practical time. Correct conditions, using temporary measures, that develop during construction to control erosion prior to the time it is practical to construct permanent control features.
- C. Construct temporary and permanent erosion and sediment control measures and maintain them to prevent the pollution of adjacent water ways in conformance with the laws, rules and regulations of Federal, State and local agencies.
- D. Copies of approved permits will be provided to the Contractor for his review and use. Contractor shall be required to comply with all General and Special Conditions noted within the permit by the particular permitting agency. The Contractor shall maintain copies of these permits on the job site at all times.

### 3.2 INSTALLATION

The following items shall be installed in accordance with the FDOT Standard Specification. The procedures are only generally described herein.

- A. Temporary Grassing: This work shall consist of furnishing and placing grass seed.
- B. Temporary Sod: This work shall consist of furnishing and placing sod.
- C. Temporary Mulching: This work shall consist of furnishing and applying a two-inch to four-inch thick blanket of straw or hay mulch and then mixing or forcing the mulch into the top two inches of the soil in order to temporarily control erosion. Only undecayed straw or hay, which can readily be cut into the soil, shall be used. Other measures for temporary erosion control such as hydro-mulching, chemical adhesive soils stabilizers, etc., may be substituted for mulching with straw or hay with the approval of the Owner. When permanent grassing operations begin, temporary mulch materials shall be plowed under in conjunction with preparation of the ground.
- D. Sandbagging: This work shall consist of furnishing and placing sandbags in configurations, so as to control erosion and siltation.
- E. Slope Drains: This work shall consist of constructing slope drains, utilizing pipe, fiber mats, rubble, cement concrete, asphaltic concrete plastic sheeting, or other acceptable materials, in accordance with the details shown in FDOT's Roadway and Traffic Design Standards or as may be approved as suitable to adequately perform the intended function.
- F. Sediment Basins: Sediment basins shall be constructed in accordance with the details shown in FDOT's Roadway and Traffic Design Standards or as suitable to adequately perform the intended function. Sediment basins shall be cleaned out as necessary.
- G. Artificial Coverings: This work shall consist of furnishing and applying fiber mats, netting, plastic sheeting, or other approved covering to the earth surfaces.
- H. Berms: This work shall consist of construction of temporary earth berms to divert the flow of water from an erodible surface.
  - 1. This work shall consist of construction of baled hay or straw dams or earth berms to protect against downstream accumulations of silt. The baled hay or straw dams shall be constructed in accordance with the details shown in FDOT's Roadway and Traffic Design Standards.
  - 2. The berm or dam shall be placed so as to effectively control silt dispersion under conditions present on this project. Alternate solutions and usage of materials may be used if approved.

### 3.3 SILT BARRIERS

- A. Silt barriers shall be installed and maintained at the locations shown on the plans. The Contractor is required to prevent the possibility of silting onto any adjacent parcel.
- B. Silt barrier shall be of the staked type and stakes shall be installed as indicated in the drawings.
- C. The height of the silt barrier fabric shall be a minimum of 42 inches.
- D. The stakes shall be 2 inch x 4 inch wood, 5 feet long and shall be spaced a maximum of 10 feet apart at the barrier location and driven securely into the ground.
- E. A trench shall be excavated approximately 4 inches wide by 4 inches deep along the line of stakes. The filter fabric shall be tied or stapled to the wooden stakes and 8 inches of fabric shall be extended into the trench. The staples shall be heavy duty wire and at least one-half (1/2) inch long. The trench shall then be backfilled and the soil compacted over the filter fabric.

### 3.4 FLOATING SILT BARRIERS

- A. Floating silt barriers where required shall be in place prior to the start of any construction or grading.
- B. Floating silt barriers shall meet or exceed the Florida Department of Transportation Roadway and Traffic Design Standards, Index No. 102, Floating Silt Barrier. Contractor shall submit fabric filter material specifications and installation configuration for approval prior to the start of construction.

### 3.5 TEMPORARY FENCE

- A. Furnish, install and maintain on wetland lines, buffer lines, tree save lines and otherwise as shown on plans. Attach silt barrier to the temporary fence.
- B. Follow manufacturer's installation recommendations.

### 3.6 MAINTENANCE

- A. Silt barriers and temporary fences shall be inspected immediately after each rainfall and at least once a day during periods of prolonged rainfall. Any repairs shall be made immediately.
- B. Should the fabric on a silt barrier or temporary fence decompose or become ineffective, the installation shall be repaired or replaced immediately at no additional

cost to the Owner. If the Contractor fails to repair or replace the items as above, the Owner shall have the right to stop work without additional cost to the Owner until such time as the repair or replacement has been made.

- C. Sediment deposits shall be removed after each storm event. The Contractor will repair and restore the installations to a working and effective condition to the satisfaction of the Owner.
- D. At the completion of all work, the silt barriers and the temporary fences will be removed if by the Owner.
- E. Any sediment deposits in place after the silt fence or filter barrier is no longer required shall be dressed to conform to the existing grade and prepared for seeding or sodding.

### 3.7 PROTECTION DURING SUSPENSION OF CONTRACT TIME

- A. In the event that it is necessary that the construction operations be suspended for any appreciable length of time, shape the top of the earthwork in such a manner as to permit run-off of rainwater and construct earth berms along the top edges of embankments to intercept run-off water. Provide temporary slope drains to carry run-off from cuts and embankments which are located in the vicinity of rivers, streams, canals, lakes and impoundments. Should such preventative measures fail, immediately take such other action as necessary to effectively prevent erosion and siltation.

END OF SECTION

## **SECTION 02281 - SOIL TREATMENT**

### **PART 1 - GENERAL**

#### **1.01 WORK INCLUDED:**

- A. Soil treatment of all areas under building to be built and all perimeter extending 1'-0" from building foundation wall.

#### **1.02 EXECUTION:**

- A. Applicator must examine the areas and conditions under which soil treatment for termite control is to be installed and notify the Contractor in writing of conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to the Applicator.

#### **1.03 GUARANTEE:**

- A. Furnish six (6) copies of written Guarantee certifying that the applied soil poisoning treatment will prevent the infestation of subterranean termites and, that if subterranean termite activity is discovered during the guarantee period, the Contractor will retreat the soil and also repair or replace damage caused by termite infestation.
- B. Subcontractor will provide a 5-year guarantee from date of application.

#### **1.04 SUBMITTALS:**

- A. Product Data; Soil Treatment For Termite Control: For information only, submit six (6) copies of manufacturer's technical data and application instructions. Transmit a copy of instructions to the Applicator.

### **PART 2 – PRODUCT**

#### **2.01 SOIL TREATMENT OF SOLUTION:**

- A. Use an emulsible concentrate insecticide for dilution with water specially formulated to prevent infestation by termites. Fuel oil will not be permitted as a dilutant. Provide a working solution of one of the following chemical elements and concentrations:
  - 1. Navigator 4TC as manufactured by GHARDA USA, Inc. or EPA accepted equal.

## 2.02 SOIL TREATMENT SOLUTION:

- A. Other solutions may be used as recommended by applicator and if acceptable to local governing authorities. Use only soil treatment solutions which are not injurious to planting and health of occupants

## PART 3 – EXECUTION

### 3.01 APPLICATION:

- A. Surface Preparation: Remove foreign matter, which could decrease effectiveness of treatment on areas to be treated. Loosen, rake, and level soil to be treated, except previously compacted areas under slabs and foundations. Toxicants may be applied before placement of compacted fill under slabs, if recommended by toxicant manufacturer.
  - 1. Application Rates: Apply soil treatment solution as follows:
    - a. Apply in rates as accepted by EPA and as recommended by the manufacturer.

### 3.02 JOB CONDITIONS:

- A. Restrictions: Do not apply soil treatment solution until excavating, filling and grading operations are completed, except as otherwise required in construction operations.
- B. To ensure penetration, do not apply soil treatment to frozen or excessively wet soils or during inclement weather. Comply with other handling and application instructions of the soil toxicant manufacturer.
- C. All application and products shall comply with EPA, State of Florida and Local County restrictions and requirements.

END OF SECTION 02281



## **SECTION 02510 - SUBGRADE STABILIZATION**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of Contract, apply to work of this Section.

#### **1.2 DESCRIPTION OF WORK**

- A. Stabilize the designated portions of the pavement subgrade in both cut and fill sections to provide a firm and unyielding subgrade to the uniformity, density, bearing value, lines, grades and thicknesses herein specified or shown in the Drawings. The work includes mixing, compacting and grading for a complete job.

### **PART 2 - MATERIALS**

- 2.1 Local Materials: High bearing-soils or sand clay material. The materials passing the #40 mesh sieve shall have a liquid limit not greater than 30, and a plasticity index not greater than 10. Blending materials to meet these requirements will not be permitted unless authorized by the Engineer. When so permitted, the blended material shall be tested and approved before spreading.
- 2.2 Limerock/Limerock Overburden: The percentage of carbonates of Calcium and magnesium shall be at least 70, and plasticity index shall not exceed 10. The gradation shall be such that 97% by weight of the material will pass a 1" sieve.
- 2.3 Crushed Shell: Mollusk shell, but not steamed shell, (i.e., oysters, mussels, clams, cemented coquina, etc.). Gradation shall be such that at least 97% by weight of the total material passes a 1" sieve, and at least 50% by weight is retained on the #4 sieve. Not more than 20% by weight of the total material shall pass (by washing) the #200 sieve.

### **PART 3 - EXECUTION**

- 3.1 Required Florida Bearing Value (FBV): Unless otherwise specified, the subgrade shall have a minimum Florida Bearing Value of 70. Where local material does not conform to the required FBV, stabilize by uniformly mixing with satisfactory local or hauled in material to the depth shown in the Drawings. Perform bearing value determination per FDOT standard specifications for Road and Bridge Construction, section 160-8.1.
- 3.2 Compaction: Compact the stabilized subgrade in both cuts and fills to a minimum density of 98% of maximum (AASHTO T-180) density. The subgrade shall be shaped to within 1/4 inch of the grades shown in the Drawings.

- 3.3 Maintenance: After the subgrade has been prepared as specified, Contractor shall maintain it free from ruts, depressions and all damage resulting from hauling or handling of any materials, equipment, tools, etc. All work which may become necessary in order to recompact the subgrade shall be at contractor's expense.
- 3.4 Testing: Provide density and bearing value tests at intervals not to exceed 250 feet for roadways or 10,000 square feet for parking areas.

END OF SECTION

## **SECTION 02511 - SOIL CEMENT**

### **PART 1.00 - GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Soil-cement surfacing.

#### **1.02 QUALITY ASSURANCE**

- A. Reference specifications and standards:
  - 1. Standard Specifications for Road and Bridge Construction, latest edition, issued by Florida Department of Transportation, specified hereinafter as FDOT.
    - a. Statements in this Specifications Section take precedence over FDOT Standards if there are ambiguities.
    - b. Where paragraphs of the FDOT Standards referenced herein include reference to further paragraphs, the further referenced paragraph(s) are also made a direct part of this Specification.
    - c. All references to "Department," "Engineer," or "District Materials Engineer" in referenced standard shall be construed to mean "Owner" for this Work.
    - d. Method of measurement and method of payment for all Work shall be construed to mean lump sum basis, in accord with terms of Contract.
    - e. Reference to Soil-Cement Base in the cited FDOT standard shall be construed to mean soil-cement surfacing work of this Section.

### **PART 2.00 - PRODUCTS**

#### **2.01 MATERIALS**

- A. Soil-cement surfacing: Conform to FDOT Section 270-2 for materials.
- B. Exceptions:
  - 1. Emulsified asphalt shall not be used for curing. Do not use any curing medium other than the natural environment. Expected slight cracking will not be a problem.
  - 2. Color of resulting soil mix shall closely match the color of the soils of the ride path.

#### **2.02 STRENGTH DESIGN**

- A. Conform to FDOT Section 270-3.2. Resulting strength of design mix shall be not less than 500 psi.

### **PART 3.00 - EXECUTION**

#### **3.01 SOIL-CEMENT SURFACING**

- A. Conform to FDOT Section 270-4 for construction methods.

1. Emulsified asphalt and consequential application of sand to aid in drying shall not be used.
2. The soil-cement surfacing for this work is intended to be the finished wearing surface.
3. Asphaltic concrete shall not be used for patching. If patching is required, use the same type soil-cement materials in the work.

END OF SECTION 02511

## **SECTION 02512 – LIMEROCK**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of Contract, apply to work of this Section.

#### **1.2 DESCRIPTION OF WORK**

- A. Construct limerock base course on the prepared subgrade as specified herein and in conformance with the lines and grades shown in the Drawings.

### **PART 2 - MATERIALS**

- 2.1 Limerock: FDOT 200-2.

### **PART 3 - EXECUTION**

- 3.1 Spreading: Uniformly spread limerock by mechanical rock spreader, equipped with a device which strikes off uniformly to laying thickness, and is capable of even distribution. Where a mechanical spreader is not practical such as crossovers, intersections and ramp areas; roadway widths of 20 feet or less; and main roadway areas when forms are used, spreading may be done by bulldozers or blade graders. Remove and replace all segregated areas of fine or course rock with properly graded rock.
- 3.2 Transportation: Transport limerock to the point of use over rock previously placed, and dump on the end of the preceding spread. Hauling over the subgrade and dumping on the subgrade will not be permitted.
- 3.3 Courses: Construct bases of specified compacted thickness greater than 6 inches in two courses. The thickness of the first course shall be approximately one-half the total thickness of the finished base, or enough additional to bear the weight of the construction equipment without disturbing the subgrade.
- 3.4 Compacting and Finishing: Clean the lower course (where applicable) of foreign material, blade the surface to a cross-section approximately parallel to the finished base. The lower course shall be tested for density prior to spreading the upper course. After the upper course has been spread, scarify and shape the surface to produce the required grade and cross-section after compaction, free of scabs and laminations.
- 3.5 Moisture Content: Material not having the proper moisture content to insure the required density, shall be wetted or dried as required. Mix-in added water uniformly by disking to the full depth of the course. Wetting and drying operations require

manipulation, as a unit, of the entire width and depth of the course which is to be compacted.

- 3.6 Density Requirements: After attaining proper moisture conditions, compact to a density of not less than 98 percent of maximum (AASHTO T-180) density.
- 3.7 Correction of Defects - If, at any time, the subgrade material should become mixed with the base course material, the Contractor shall, without additional compensation, dig out and remove the mixture, reshape and compact the subgrade and replace the materials removed with clean base material, which shall be shaped and compacted as cited herein.

Cracks or checks appearing in the base, either before or after priming, which would impair the structural efficiency of the base, shall be removed by rescarifying, reshaping, adding base material, recompacting and repriming without additional compensation.

- 3.8 Priming and Maintaining: Apply the prime coat only when the base meets the specified density requirements, and the moisture content in the top half of the base does not exceed 90 percent of the optimum moisture of the base material. At the time of priming, the base shall be firm, unyielding and in such condition that no undue distortion will occur.

Maintain the true crown and template, with no rutting or other distortion, and insure that the base meets all requirements at the time the surface course is applied.

- 3.9 Surface Requirement: Irregularities greater than 1/4 inch, when checked with a template cut to the required crown and with a 15-foot straightedge laid parallel to the center of the roadway, shall be corrected by scarifying and removing or adding rock as required and recompacting the entire area as specified.
- 3.10 Thickness Requirement: Where the base is deficient by more than 1/2 inch, it shall be reworked to the area extent specified by the testing laboratory and to a depth of at least 3 inches by scarifying and adding more base material, so that after proper compaction the thickness will conform to the Drawings.
- 3.11 Testing Density: Provide three density determinations on each day's final compaction operation on each course. Blading to grade where required shall be completed prior to density testing.
- A. Surface: Check the finish surface of the base course with a template cut to the required crown and with a 15-foot straight edge laid parallel to the center of the roadway.
- 3.12 Thickness: Provide test holes at intervals not to exceed 250 feet for roadways or 10,000 square feet for parking areas.

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SECTION 02512  
LIMEROCK

END OF SECTION

## **SECTION 02513 - ASPHALT CONCRETE PAVING**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of Contract apply to work of this Section.

#### **1.2 DESCRIPTION OF WORK**

- A. Extent of asphalt concrete paving work is shown on drawings.
- B. Prepared aggregate subbase and base is specified in "SUBGRADE STABILIZATION," "LIMEROCK" and "SOIL CEMENT" Sections.
- C. Prepared subgrade is specified in "EARTHWORK" Section.
- D. Saw-cutting of edges of existing pavement is specified in site clearing section.

#### **1.3 SUBMITTALS**

- A. Material Certificates: Provide copies of materials certificates signed by material producer and Contractor, certifying that each material item complies with, or exceeds, specified requirements.

#### **1.4 QUALITY ASSURANCE**

- A. Codes and Standards: Comply with State highway or transportation department standard specifications, latest edition, and with local governing regulations if more stringent than herein specified.

### **PART 2 - PRODUCTS**

#### **2.1 MATERIALS**

General: Use locally available materials and gradations which exhibit a satisfactory record of previous installations.

- A. Type S Asphaltic Concrete: FDOT, 331-2, 3, 4, 5.
- B. Type III Cement Asphaltic Concrete: FDOT, 333-2, 3, 4 and 5.
- C. Asphalt Cement: FDOT, 916-1



- D. Prime Coat: Cut-back asphalt grade RC-70 or RC-250 per FDOT 916-2; emulsified asphalt grade SS-1 or SS1H, per FDOT 916-4, diluted in equal proportions with water; or other types and grades of bituminous material.
- E. Tack Coat: Emulsified asphalt; RS-2, SS-1, or SS-1H (diluted in equal proportions with water) per FDOT 916-4. Cut-back asphalt RL-70, or asphalt cement, penetration grade 85-100.
- F. Lane Marking Paint: Chlorinated rubber-alkyd type, AASHTO M 248 (FS TT-P-115), Type III or per FDOT 971-12.2.
- G. Thermoplastic Traffic Stripes and Markings: Per FDOT standard specifications for Road and Bridge Construction, Section 711.
- H. Wheel Stops: Precast of 3,500 psi air-entrained concrete, approximately 6 inches high, and 6 feet 0 inches long, with chamfered corners and drainage slots on underside.

## 2.2 ASPHALT-AGGREGATE MIXTURE AND PREPARATIONS

- A. FDOT 330-5, and FDOT 330-6.

## PART 3 - EXECUTION

### 3.1 WEATHER LIMITATIONS

- A. Mixture shall not be spread when the air temperature is not greater than 40° F, in the shade (away from artificial heat), or there is evidence of a frozen base, or when the wind is blowing to such an extent that proper and adequate compaction cannot be maintained or when sand, dust, etc., are being deposited on the surface being paved.

Any mixture caught in transit by a sudden rain may be laid only at Contractor's risk. Should such mixture prove unsatisfactory, it shall be removed and replaced at Contractor's expense. In no case shall the mixture be laid while rain is falling or when there is water on the surface to be covered.

### 3.2 PREPARATION OF ASPHALT CEMENT

- A. Heat the asphalt cement in advance of the mixing operations, to within a range of 270° F to 350° F. Maintain the heating operations constant within these limits. Wide temperature fluctuations during the day will not be permitted.

### 3.3 PREPARATION OF AGGREGATE

FDOT 330-5

### 3.4 PREPARATION OF MIXTURE

FDOT 330-6

### 3.5 TRANSPORTATION OF MIXTURE

Transport the mixture in vehicles clean of foreign material properly equipped to be covered during inclement weather. Coat the inside surfaces of the truck with soapy water or approved emulsion containing less than 5 percent oil (not kerosene, gasoline or similar products) and raise beds to drain excess prior to loading.

### 3.6 PREPARATION OF APPLICATION SURFACES

- A. Cleaning: Thoroughly clean the surface to be covered of all loose and deleterious material before laying any mixture.
- B. Patching and Leveling Courses: Where a surface course is constructed on an existing pavement or base and/or where called for in the Drawings, apply patching or leveling courses to bring the existing surface to proper grade and cross-section. Prior to spreading leveling courses, all depressions in the existing surface more than one inch deep shall be filled by spot patching with leveling course mixture, and then thoroughly compacted.
- C. Coating Surfaces of Contacting Structures: Paint all structures such as manholes, inlet, valve boxes, etc., with a uniform coating of asphaltic cement.
- D. Prime Coat: Prime materials shall be uniformly applied using a pressure distributor at the minimum rates of 0.10 gallons per square yard for limerock, limerock stabilized and local rock bases, and 0.15 gallons per square yard for sand, clay, shell and shell stabilized bases. The actual amount to be applied shall be dependent on the character of the surface and shall be sufficient to coat the surface thoroughly without having any access to form pools or to flow off the base. The temperature of the prime material shall be that temperature between 100° F and 150° F, which will insure uniform distribution. The moisture content of the base shall not be greater than 90 percent of optimum to obtain adequate penetration.

Apply a light uniform application of cover material and roll with a traffic roller for at least 10 passes before opening to traffic. Where an emulsified asphalt is used for prime coat, the Engineer may require that cover material be hot-asphalt coated with two to four percent asphalt-cement, if necessary, to achieve a prime coat which will remain reasonably intact until the surface course is placed; the application rate shall be approximately 10 pounds per square yard.

### 3.7 TACK COAT

A tack coat will only be required on primed bases in areas that have become excessively dirty and cannot be cleaned, or in areas where the prime has cured to the extent that it has lost adequate bonding effect. Generally, a tack coat will be required on bituminous base or leveling courses before placing the surface course.

Apply tack, suitably heated, at the minimum rate necessary to bond the wearing surface to the base (between 0.02 and 0.08 gallons per square yard). The upper limit may be exceeded for resurfacing concrete. Apply tack sufficiently in advance of the wearing course to permit drying but not so far in advance to allow loss of adhesiveness from dust and other foreign material. No traffic shall be allowed on the tacked surface.

### 3.8 PLACING MIXTURE

- A. Mixture shall be placed and spread only after the surface to be overlaid is properly prepared, intact, firm, properly cured and dried. No mixture shall be spread that cannot be finished and compacted during the daylight hours of day of spreading.

Spread the mixture with mechanical spreaders, except where impracticable. A stringline shall be used to obtain an accurate, uniform alignment of the pavement edge. The temperature of the mixture at the time of spreading shall be between 270° F and 350° F.

1. Checking Depth of Layer: The depth of each layer shall be checked by the Contractor at intervals, not to exceed 25 feet. Any deviation from the required thickness, in excess of the allowable tolerance, shall be immediately corrected.

- B. Surface Courses:

1. Spreading and Finishing: Immediately upon arrival, the mixture shall be dumped into the spreader, spread and struck-off to the full width required and to such loose depth to secure the specified thickness. Excess mixture shall be carried ahead of the screed at all times. Hand rake behind the machine as required.
2. Thickness of Layers: Surface courses of thickness greater than two inches, shall be constructed in approximately equal layers and of less than two inches compacted thickness. Each layer shall be thoroughly compacted and shall conform to these specifications prior to overlaying.
3. Correcting Defects: Prior to rolling, the surface shall be checked, and irregularities adjusted. All drippings, fat sandy accumulations from the screed, and fat spots from any source shall be removed and replaced with satisfactory material. No skin patching shall be done. Where a depression is to be corrected while the mixture is hot, the surface shall be well scarified before the addition of fresh mixture.

- C. Leveling Courses:

1. Spreading: The initial and intermediate leveling courses shall be placed by a spreader box, working conjunction with two motor graders. The final leveling course shall be placed by a paving machine. However, if the total quantity of leveling to be applied is less than 150 pounds per square yard, the paving machine may not be required.

2. Application Rates: The application rate of leveling mixture shall not exceed 50 pounds per square yard per course except Type S-1 asphaltic concrete leveling shall not exceed 75 pounds per square yard per course. The actual application rate shall be as required to establish the finished lines and grades shown in the Drawings and shall not be limited to any average or typical rate or thickness which may be shown in the Drawings.
3. Leveling Over Existing Concrete Pavement: Remove all excess joint filler to flush with the existing pavement. For broken concrete pavement (with or without existing asphalt surface) the first leveling course shall be placed as soon after, but not later than 2 days after, the cracking and resealing operation.

### 3.9 COMPACTING MIXTURE

Density required for asphaltic concrete pavement, after final compaction, shall be at least 95 percent of the laboratory compacted density of the paving mixture. Tests shall be performed every 500 feet for roadways and 50,000 square feet for parking areas.

- A. Equipment and Sequence: For each paving or leveling train in operation, the Contractor shall furnish a separate set of rollers, with operators. The rolling shall be done in sequence, and with the equipment as follows, unless otherwise permitted by the Engineer:
  1. Seal Rolling - Use tandem steel rollers weighing 5 to 12 tons, following as close behind the spreaders as is possible without pick-up, undue displacement or blistering of the material.
  2. Rolling with Traffic Roller - Use self-propelled pneumatic-tired rollers, 6 to 10 tons and tire pressure to 55 pounds, following as close behind the seal rolling as the mix will permit. The roller shall cover every portion of the surface with at least five passes.
  3. Final Rolling - Use tandem steel roller, weighing 8 to 12 tons after the pneumatic-tired rolling has been completed, but before the pavement temperature has dropped below 140° F.
- B. Compaction of Crossovers, Intersections, etc.: Where a separate paving machine is used to pave crossovers, compaction may be done by one 8 to 10 ton tandem steel roller. If crossovers, intersections and acceleration and deceleration lanes are placed with the main run of paving, a traffic roller shall also be used in the compaction.
- C. Rolling Procedures: The rolling shall be longitudinal. Where the lane being placed is adjacent to a previously placed lane, the center joint shall be pinched or rolled, prior to rolling of the rest of the lane. Continue across the mat, overlapping each previous roller path by at least one-half the width of the roller wheel. The motion of the roller shall be slow enough to avoid displacement of the mixture, and any displacement shall be

corrected at once by the use of rakes, and the addition of fresh mixture if required. Final rolling shall continue until all roller marks are eliminated.

Self-propelled, pneumatic-tired traffic rollers shall proceed at a speed of 6 to 10 miles per hour; the area covered by each roller shall not exceed 4,000 square yards per hour, except that for Type S-1 Asphaltic Concrete, the maximum shall be 3,000 square yards per hour.

- D. Number of Traffic Rollers Required: A sufficient number of self-propelled pneumatic-tired rollers shall be used to assure that the rolling will not delay any other phase of the laying operation nor result in excessive cooling of the mixture. In the event that the rolling falls behind, the laying operation shall be discontinued until the rolling operations are sufficiently caught up.
- E. Rolling Patching and Leveling Courses: Use self-propelled pneumatic-tired rollers for all patching and leveling courses. Where the initial leveling course is placed over broken concrete pavement, the pneumatic-tired rollers shall weight at least 15 tons. For Type S-I Asphaltic Concrete leveling courses, use a steel-wheeled roller, to supplement the traffic rollers. The use of a steel-wheeled roller will otherwise be at Contractor's option.

Areas which are inaccessible to a roller (such as areas adjacent to curbs, headers, gutters, manholes, etc.) shall be compacted by the use of hand tamps or other satisfactory means.

- F. Correcting Defects: Rollers shall not deposit gasoline, oil or grease onto the pavement. Any areas damaged by such deposits shall be removed and replaced. While rolling is in progress, the surface shall be tested continuously and all discrepancies corrected to comply with the surface requirements. All drippings, fat or lean areas and defective construction of any description shall be removed and replaced. Depressions which develop before the completion of the rolling shall be remedied by loosening the mixture and adding new mixture to bring the depressions to a true surface. Should any depressions remain after the final compaction has been obtained, the full depth of the mixture shall be removed and replaced with sufficient new mixture to form a true and even surface. All high spots, joints and honeycomb shall be corrected. Any mixture remaining unbonded after rolling shall be removed and replaced. Any mixture which becomes loose or broken, mixed or coated with dirt or in any way defective, prior to laying the wearing course shall be removed and replaced with fresh mixture which shall be immediately compacted to conform with the surrounding area. Areas of defective surface may be repaired by the use of the indirect heat. No method of repair involving open-flame heaters shall be used.
- G. Provisions Applicable to Shoulder Pavement Only: Where sand-asphaltic shoulders are constructed within the limits of curb and gutter, compaction shall be done by light weight rolling equipment, which will not displace the previously constructed curb and gutter.

### 3.10 JOINTS

- A. Fresh mixture shall be laid against the exposed edges at joints (trimmed or formed as provided below) in close contact with the exposed edge so that an even, well-compacted joint will be produced after rolling.
1. Transverse Joints: Placing of the mixture shall be as continuous as possible. The roller shall not pass over the unprotected end of the freshly laid mixture except when the laying operation is to be discontinued long enough to permit the mixture to become chilled. When the laying operation is thus interrupted, a transverse joint shall be constructed by cutting back on the previous run to expose the full depth of the mat.
  2. Longitudinal Joints: Where a portion of the width of pavement is to be laid and opened to traffic, longitudinal joints shall be formed by rolling the exposed edge of the strip first laid. When the adjacent strip is constructed, the Engineer may require the edge of the mixture in place to be trimmed back to expose an unsealed or granular vertical surface. Where the strip first laid is closed to traffic, the edge shall not be sealed but shall be left vertical and the adjacent strip placed against it without trimming.

### 3.11 SURFACE REQUIREMENTS & CORRECTION:

- A. The finished surface shall not vary more than 3/16 inch when measured by rolling or manual straightedge applied parallel to the center line of the pavement. Any surface irregularities exceeding such limits shall be corrected as specified herein.
1. Manual Straightedging: A 15-foot manual straightedge shall be furnished by the Contractor and shall be available at all times on the work. The Contractor shall designate an employee whose duty it is to handle the straightedge in checking the compacted surfaces.
  2. Texture of Finished Surfaces: The finished surface shall be of uniform texture and compaction. The surface shall have no pulled, torn or loosened portions, and shall be free of sand streaks, sand spots or ripples. (These requirements shall also apply to any areas where it is necessary to apply hand work.) Defective area shall be corrected as follows:
    - a. If the correction is made by replacing of the full thickness, it shall extend to at least 50 feet each side of the defective area.
    - b. If the correction is made by overlaying, the overlay shall consist of at least 100 pounds of mixture per square yard at the defective section and shall taper uniformly down from the full thickness of such weight, to zero thickness (featheredged) at the end of a minimum length of 50 feet each side of the defective area.

### 3.12 PROTECTION OF FINISHED SURFACE

- A. Finished surfaces including courses to be overlaid shall be kept clean and no dumping of any material onto the surfaces shall be permitted. Protect pavement against damage during shoulder construction by providing proper attachments to grader

blades. Vehicular traffic shall not be permitted until the pavement has set sufficiently to prevent rutting or other distortion.

### 3.13 TRAFFIC AND LANE MARKINGS

- A. Cleaning: Sweep and clean surface to eliminate loose material and dust.
- B. Striping: Use chlorinated-rubber base traffic lane-marking paint, factory-mixed, quick-drying, and non-bleeding.
  - 1. Color: white and yellow as indicated on drawings.
    - a. Apply paint with mechanical equipment to produce uniform straight edges. Apply in 2 coats at manufacturer's recommended rates.

### 3.14 WHEEL STOPS

- A. Secure wheel stops to asphalt concrete surface with not less than two 3/4 inch diameter steel dowels embedded in precast concrete at 1/3 points. Size length of dowel to penetrate at least 6 inches into asphalt concrete. Drill placement holes oversize and embed dowels in hot bituminous grout material.

### 3.15 FIELD QUALITY CONTROL

- A. THICKNESS REQUIREMENTS & CORRECTIONS
  - 1. Pavement thickness shall be determined from the length of the core borings as specified herein. The maximum allowable deficiency from the specified thickness and serious deficiency thickness shall be as follows:
    - a. Pavement of specified thickness 1 1/2 inches or less
      - Maximum allowable deficiency 3/16 inch or more
      - Serious deficiency 1/4 inch or more
    - b. Pavement of specified thickness greater than 1 1/2 inches but less than 2 1/2 inches
      - Maximum allowable deficiency 1/4 inch or more
      - Serious deficiency 3/8 inch or more
    - c. Pavement of specified thickness 2 1/2 inches or greater
      - Maximum allowable deficiency 1/2 inch or more
      - Serious deficiency 3/4 inch or more
  - 2. Contractor shall correct seriously deficient areas either by replacing the full thickness for a length extending at least 50 feet from each end of the deficient area, or (when permitted by the Engineer) by overlaying as specified herein at his own expense.

As an exception to the above, pavement outside a main roadway area (acceleration and deceleration lanes, crossovers and parking areas) may be left in place, without compensation (except for payment for the bituminous material), when so permitted by the Engineer, even though the thickness deficiency exceeds the serious deficiency tolerance specified above.

Where the deficiency exceeds allowable but does not exceed serious, Contractor will be allowed to leave such pavement in place, but without compensation other than for the bituminous material contained therein. The areas of such pavement for which no square yard payment will be made shall be the product of the total distance between acceptable cores, multiplied by the width of the lane which was laid at the particular pass in which deficient thickness was indicated. To determine the extent of the deficiencies, additional cores will be taken as required.

3. Correcting Deficiency by Adding New Surface Material: For any case of excess deficiency of the pavement, Contractor will be permitted, if approved by the Engineer for each particular location, to correct the deficient thickness by adding new surface material and compacting to the same density as the adjacent surface. The area to be corrected and the thickness of the new material added shall be as specified herein. All costs of the overlaying and compacting shall be borne by the Contractor.

B. CALCULATION FOR THICKNESS OF PAVEMENT

1. Core Borings: The thickness of the pavement shall be determined from the length of cores, at least two inches in diameter, taken at random points along the roadway and the parking areas. Each core shall represent a roadway section not longer than 500 feet or a parking area not less than 10,000 square feet. The average thickness shall be determined from the measured thicknesses, and in accordance with the procedure and criteria specified herein.

If it is found that the specified pavement thickness has not been installed per this specification and if Contractor believes that the number of cores taken by the Owner is insufficient to properly indicate the thickness of the pavement, he may request the owner make additional borings at locations designated by him. The cost of these additional borings shall be deducted from any sums due Contractor unless such borings indicate that the pavement within the questioned area is of specified thickness.

2. Criteria for Calculations:
  - a. Average thickness shall be calculated for the total length of project.
  - b. When the thickness as measured by the cores is more than 1/2 inch greater than the specified thickness, it shall be considered in the calculation as the specified thickness plus 1/2 inch.
  - c. Areas of deficient thickness pavement which are left in place with no compensation shall not be taken into account in the calculations.



- d. Where areas of defective surface or deficient thickness are corrected by overlaying with additional material, the thickness used in the calculations shall be the specified thickness for such areas.

C. TESTING

- 1. The contractor shall provide, at his expense, the following tests before stating any laying operations:
  - a. Determination of the job mix formula
  - b. Tests of the asphalt cement
  - c. Sieve analysis of the aggregate
  - d. Determination of bitumen content of the asphalt concrete

END OF SECTION

## SECTION 02520 - PORTLAND CEMENT CONCRETE PAVING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract apply to work of this Section.

#### 1.2 DESCRIPTION OF WORK

- A. Extent of portland cement concrete paving is shown on drawings, including curbs, gutters, walkways and pavement.
- B. Prepared subgrade is specified in "EARTHWORK" section.
- C. Concrete and related materials are specified in Division-3.
- D. Joint fillers and sealers are specified in Division-7.

#### 1.3 QUALITY ASSURANCE

- A. Codes and Standards: Comply with local governing regulations if more stringent than herein specified.

#### 1.4 SUBMITTALS

- A. Furnish samples, manufacturer's product data, test reports, and materials' certifications as required in referenced sections for concrete and joint fillers and sealers.

#### 1.5 JOB CONDITIONS

- A. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities.

Comment [COMMENT1]: DELETE BELOW IF NOT REQUIRED.

### PART 2 - PRODUCTS

#### 2.1 MATERIALS

- A. Forms: Steel, wood, or other suitable material of size and strength to resist movement during concrete placement and to retain horizontal and vertical alignment until removal. Use straight forms, free of distortion and defects.
  - 1. Use flexible spring steel forms or laminated boards to form radius bends as required.
  - 2. Coat forms with a non-staining form release agent that will not discolor or deface

surface of concrete.

- B.** Welded Wire Mesh: Welded plain cold-drawn steel wire fabric, ASTM A 185.
1. Furnish in rolls, unless otherwise acceptable to Architect.
- C.** Reinforcing Bars: Deformed steel bars, ASTM A 615, Grade 40.
- D.** Joint Dowel Bars: Plain steel bars, ASTM A 615, Grade 40. Cut bars true to length with ends square and free of burrs.
- E.** Metal Expansion Caps: Furnish for one end of each dowel bar in expansion joints. Design caps with one end closed and a minimum length of 3 inches to allow bars movement of not less than 1 inch, unless otherwise indicated.
- F.** Hook Bolts: ASTM A 307, Grade A bolts, internally and externally threaded. Design hook bolt joint assembly to hold coupling against pavement form and in position during concreting operations, and to permit removal without damage to concrete or hook bolt.
- G.** Concrete Materials: Comply with requirements of applicable Division-3 sections for concrete materials, admixtures, bonding materials, curing materials, and others as required.
- H.** Expansion Joint Materials: Comply with requirements of applicable Division-7 sections for preformed expansion joint fillers and sealers.
- I.** Anti-Spalling Compound: 50% (by volume) boiled linseed oil and 50% (by volume) mineral spirits, complying with AASHTO M-233.
- J.** Liquid-Membrane Forming Curing Compound: Complying with ASTM C 309, Type I, Class A unless other type acceptable to Architect. Moisture loss not more than 0.055 gr./sq. cm. when applied at 200 sq. ft./gal.
1. Available Products: Subject to compliance with requirements, products which may be incorporated in the work include, but are not limited to, the following:
- "Masterseal"; Master Builders.  
"A-H 3 Way Sealer"; Anti-Hydro Waterproofing Co.  
"Ecocure"; Euclid Chemical Co.  
"Clear Seal"; A.C. Horn.  
"J-20 Acrylic Cure"; Dayton Superior.  
"Sure Cure"; Kaufman Products Inc.  
"Spartan-Cote"; The Burke Co.  
"Sealkure"; Toch Div. - Carboline.  
"Kure-N-Seal"; Sonneborn-Contech.  
"Polyclear"; Upco Chemical/USM Corp.

**Comment [COMMENT2]:** DELETE MATERIALS NOT REQUIRED. REVISE OR ADD TO SUIT PROJECT.

**Comment [COMMENT3]:** DELETE BELOW IF NONE.

**Comment [COMMENT4]:** DELETE BELOW IF NONE. PLASTIC-SURFACED DOWELS AVAILABLE FROM PROPRIETARY SOURCES.

**Comment [COMMENT5]:** DELETE BELOW IF NONE OR IF PLASTIC-SURFACED DOWELS SPECIFIED. RETAIN FOR DOWELS.

**Comment [COMMENT6]:** DELETE BELOW IF NONE. FOR CONNECTION BETWEEN NEW AND EXISTING PAVING, AND BETWEEN PAVING AND GUTTERS.

**Comment [COMMENT7]:** ADD SPECIFIC ITEMS (CEMENT COLOR, SPECIAL AGGREGATES, ETC.) TO SUIT PROJECT.

**Comment [COMMENT8]:** ABOVE MATERIAL (TYPE I, CLASS A) IS CLEAR OR TRANSLUCENT WITH NO RESTRICTIONS ON VEHICLE COMPOSITION. "TYPE 1-D" CONTAINS A FUGITIVE DYE (DISAPPEARS WITHIN 7 DAYS), "TYPE 2" IS WHITE PIGMENTED, AND "CLASS B" IS AN ALL RESINOUS VEHICLE.

**Comment [COMMENT9]:** RETAIN ABOVE OR BELOW, FOR NONPROPRIETARY OR SEMIPROPRIETARY.

"L&M Cure"; L & M Construction Chemicals.  
"Klearseal"; Setcon Industries.  
"LR-152"; Protex Industries.  
"Hardtop"; Gifford - Hill.

- K. Bonding Compound: Polyvinyl acetate or acrylic base, rewettable type.
1. Available Products: Subject to compliance with requirements, products which may be incorporated in the work include, but are not limited to, the following:

"J-40 Bonding Agent"; Dayton Superior Corp.  
"Weldcrete"; Larsen Products.  
"Everbond"; L & M Construction Chemicals.  
"EucoWeld"; Euclid Chemical Co.  
"Hornweld"; A. C. Horn.  
"Sonocrete"; Sonneborn-Contech.  
"Acrylic Bondcrete"; The Burke Co.

**Comment [COMMENT10]:** RETAIN ABOVE OR BELOW, FOR NONPROPRIETARY OR SEMIPROPRIETARY SPECIFICATION.

- L. Epoxy Adhesive: ASTM C 881, two component materials suitable for use on dry or damp surfaces. Provide material "Type," "Grade," and "Class" to suit project requirements.

1. Available Products: Subject to compliance with requirements, products which may be incorporated in the work include, but are not limited to, the following:

"Epoxite"; A. C. Horn.  
"Edoco 2118 Epoxy Adhesive"; Edoco Technical Prod.  
"Sikadur Hi-Mod"; Sika Chemical Corp.  
"Euco Epoxy 463 or 615"; Euclid Chemical Co.  
"Patch and Bond Epoxy"; The Burke Co.  
"Sure-Poxy"; Kaufman Products Inc.

**Comment [COMMENT11]:** RETAIN ABOVE OR BELOW, FOR NONPROPRIETARY OR SEMIPROPRIETARY SPECIFICATION.

## 2.2 CONCRETE MIX, DESIGN AND TESTING

- A. Comply with requirements of applicable Division-3 sections for concrete mix design, sampling and testing, and quality control, and as herein specified.

**Comment [COMMENT12]:** COORDINATE WITH DIVISION-3 SECTIONS.

Design mix to produce normal-weight concrete consisting of portland cement, aggregate, water-reducing of high-range water-reducing admixture (super-plasticizer), air-entraining admixture and water to produce the following properties:

1. Compressive Strength: 3000 psi, minimum at 28 days, unless otherwise indicated.
2. Slump Range: 8 inches for concrete containing HRWR admixture (super-plasticizer); 3 inches for other concrete.

**Comment [COMMENT13]:** REVIEW BELOW AND REVISE TO SUIT PROJECT. ADD MINIMUM FLEXURAL STRENGTH AND MAX. WATER-CEMENT RATIO IF REQUIRED FOR PAVING.

**Comment [COMMENT14]:** USE W-C RATIO OF 0.53 FOR CONC. SUBJECT TO FREEZE/THAW; USE W-C 0.45 SUBJECTED TO DEICERS.

3. Air Content: 5% to 8%.

### PART 3 - EXECUTION

#### 3.1 SURFACE PREPARATION

- A. Remove loose material from compacted subgrade surface immediately before placing concrete.

Proof-roll prepared subbase surface to check for unstable areas and need for additional compaction. Do not begin paving work until such conditions have been corrected and are ready to receive paving.

**Comment [COMMENT15]:** DELETE BELOW IF NOT REQUIRED.

#### 3.2 FORM CONSTRUCTION

- A. Set forms to required grades and lines, rigidly braced and secured. Install sufficient quantity of forms to allow continuous progress of work and so that forms can remain in place at least 12 hours after concrete placement.

Check completed formwork for grade and alignment to following tolerances:

1. Top of forms not more than 1/8 inch in 10 feet.
2. Vertical face on longitudinal axis, not more than 1/4 inch in 10 feet.

**Comment [COMMENT16]:** DELETE BELOW, OR REVISE TOLERANCES, TO SUIT PROJECT.

Clean forms after each use, and coat with form release agent as often as required to ensure separation from concrete without damage.

#### 3.3 REINFORCEMENT

- A. Locate, place and support reinforcement as specified in Division-3 sections, unless otherwise indicated.

**Comment [COMMENT17]:** DELETE BELOW IF REINFORCING TO BE PLACED INTEGRALLY WITH CONCRETE.

#### 3.4 CONCRETE PLACEMENT

- A. General: Comply with requirements of Division-3 sections for mixing and placing concrete, and as herein specified.

1. Do not place concrete until subbase and forms have been checked for line and grade. Moisten subbase if required to provide a uniform dampened condition at time concrete is placed. Do not place concrete around manholes or other structures until they are at required finish elevation and alignment.
2. Place concrete using methods which prevent segregation of mix. Consolidate concrete along face of forms and adjacent to transverse joints with internal vibrator. Keep vibrator away from joint assemblies, reinforcement, or side forms. Use only square-faced shovels for hand-spreading and consolidation. Consolidate with care to prevent dislocation of reinforcing, dowels, and joint devices.

Deposit and spread concrete in a continuous operation between transverse joints, as far as possible. If interrupted for more than 1/2-hour, place a construction joint.

3. Fabricated Bar Mats: Keep mats clean and free from excessive rust, and handle units to keep them flat and free of distortions. Straighten bends, kinks, or other irregularities or replace units as required before placement. Set mats for a minimum 2 inches overlap to adjacent mats.

Place concrete in 2 operations; strike-off initial pour for entire width of placement and to the required depth below finish surface. Lay fabricated bar mats immediately in final position. Place top layer of concrete, strike-off and screed.

- a. Remove and replace portions of bottom layer of concrete which has been placed more than 15 minutes without being covered by top layer or use bonding agent if acceptable to Architect.

**Comment [COMMENT18]:** DELETE BELOW IF NOT REQUIRED.

**Comment [COMMENT19]:** DELETE BELOW IF STANDARD REINFORCING BARS AND SETTING IS DONE BEFORE CONCRETE PLACEMENT.

### 3.5 JOINTS

- A. General: Construct expansion, weakened-plane (contraction), and construction joints true-to-line with face perpendicular to surface of concrete. Construct transverse joints at right angles to the centerline, unless otherwise indicated.

When joining existing structures, place transverse joints to align with previously placed joints, unless otherwise indicated.

1. Weakened-Plane (Contraction) Joints: Provide weakened-plane (contraction) joints, sectioning concrete into areas as shown on drawings. Construct weakened-plane joints for a depth equal to at least 1/4 concrete thickness, as follows:

- a. Tooled Joints: Form weakened-plane joints in fresh concrete by grooving top portion with a recommended cutting tool and finishing edges with a jointer.

2. Construction Joints: Place construction joints at end of placements and at locations where placement operations are stopped for a period of more than 1/2-hour, except where such placements terminate at expansion joints.

- a. Construct joints as shown or, if not shown, use standard wood or metal keyway-section forms.
- b. Where load transfer-slip dowel devices are used, install so that one end of each dowel bar is free to move.

3. Expansion Joints: Provide premolded joint filler for expansion joints abutting concrete curbs, catch basins, manholes, inlets, structures, walks and other fixed objects, unless otherwise indicated.

**Comment [COMMENT20]:** COORDINATE JOINT TYPE(S) AND LOCATION WITH DRAWINGS.

**Comment [COMMENT21]:** SELECT TYPE OF JOINT-FORMING METHOD REQUIRED, OR RETAIN ALL AT CONTRACTOR'S OPTION. ADD SPACING OF JOINTS IF NOT SHOWN ON DRAWINGS.

**Comment [COMMENT22]:** DELETE BELOW IF SAW-CUTTING NOT PERMITTED.

**Comment [COMMENT23]:** DELETE BELOW IF NONE.

**Comment [COMMENT24]:** COORDINATE BELOW WITH DIVISION-7 SECTIONS.

Locate expansion joints at spacings indicated.

Extend joint fillers full-width and depth of joint, and not less than 1/2 inch or more than 1 inch below finished surface where joint sealer is indicated. If no joint sealer, place top of joint filler flush with finished concrete surface.

Furnish joint fillers in one-piece lengths for full width being placed, wherever possible. Where more than one length is required, lace or clip joint filler sections together.

Protect top edge of joint filler during concrete placement with a metal cap or other temporary material. Remove protection after concrete has been placed on both sides of joint.

4. Fillers and Sealants: Comply with the requirements of applicable Division-7 sections for preparation of joints, materials, installation, and performance.

### 3.6 CONCRETE FINISHING

- A. After striking-off and consolidating concrete, smooth surface by screeding and floating. Use hand method only where mechanical floating is not possible. Adjust floating to compact surface and produce uniform texture.

After floating, test surface for trueness with a 10' straightedge. Distribute concrete as required to remove surface irregularities, and refloat repaired areas to provide a continuous smooth finish.

Work edges of slabs, gutters, back top edge of curb, and formed joints with an edging tool, and round to 1/2 inch radius, unless otherwise indicated. Eliminate tool marks on concrete surface.

After completion of floating and troweling when excess moisture or surface sheen has disappeared, complete surface finishing, as follows:

1. Broom finish, by drawing a fine-hair broom across concrete surface, perpendicular to line of traffic. Repeat operation if required to provide a fine line texture acceptable to Architect.
2. On inclined slab surfaces, provide a coarse, non-slip finish by scoring surface with a stiff-bristled broom, perpendicular to line of traffic.

Do not remove forms for 12 hours after concrete has been placed. After form removal, clean ends of joints and point-up any minor honeycombed areas. Remove and replace areas or sections with major defects, as directed by Architect.

### 3.7 CURING

**Comment [COMMENT25]:** REVISE SPACING OF EXPANSION JOINTS TO SUIT PROJECT.

**Comment [COMMENT26]:** SELECT FINISH, OR REVISE TO SUIT PROJECT. ADD SPECIFIC REQUIREMENTS FOR SPECIAL (EXPOSED AGGREGATE, ETC.) FINISHES.

**Comment [COMMENT27]:** DELETE BELOW IF NONE, OR REVISE FOR SPECIFIC TEXTURE.

- A. Protect and cure finished concrete paving, complying with applicable requirements of Division-3 sections. Use membrane-forming curing and sealing compound or approved moist-curing methods.

3.8 REPAIRS AND PROTECTIONS

- A. Repair or replace broken or defective concrete, as directed by Architect.
- B. Drill test cores where directed by Architect, when necessary to determine magnitude of cracks or defective areas. Fill drilled core holes in satisfactory pavement areas with portland cement concrete bonded to pavement with epoxy adhesive.
- C. Protect concrete from damage until acceptance of work. Exclude traffic from pavement for at least 14 days after placement. When construction traffic is permitted, maintain pavement as clean as possible by removing surface stains and spillage of materials as they occur.

Sweep concrete pavement and wash free of stains, discolorations, dirt and other foreign material just prior to final inspection.

END OF SECTION

Comment [COMMENT28]: DELETE BELOW  
IF ANTI-SPALLING TREATMENT NOT  
REQUIRED.



## **SECTION 02577 - PAVEMENT MARKINGS**

### **PART 1 - GENERAL**

#### **1.1 WORK INCLUDED**

- A. Pavement markings.

#### **1.2 RELATED WORK SPECIFIED ELSEWHERE**

- A. Asphalt concrete paving - Section 02513

#### **1.3 SUBMITTALS**

- A. Procedure: Submit in accord with General Conditions.
- B. Product data: Submit manufacturer's detailed literature.

### **PART 2 - MATERIALS**

#### **2.1**

- A. Pavement marking paint: Tnemec's Traffic Paint, Glidden-Durkee's Romark Traffic, PPG's Traffic and Zone Marking
  - 1. Provide marking paint for perimeter and marking outside traffic flow patterns or in areas where existing markings have been disturbed.

### **PART 3 - EXECUTION**

#### **3.1 PAINT MARKINGS APPLICATION**

- A. Obtain approval of marking layouts prior to paint application.
- B. Traffic line markings: 4 inches wide unless otherwise indicated.
- C. Machine apply in strict accord with recommendations of paint manufacturer.
- D. Apply two coats or more as required for complete opacity.
  - 1. Apply first coat after all paved surfaces to be painted are dry and cured for a minimum of 48 hours.
  - 2. Apply second or final coat prior to completion of project.
- E. Paint directional lettering, arrows and other markings by similar methods with same paint. Use stencils and masking tape as required to achieve required designs.

ORANGE COUNTY – THREE POINTS MAINTENANCE  
ORANGE COUNTY, FLORIDA

SECTION 02577  
PAVEMENT MARKINGS

END OF SECTION

## **SECTION 02580 - CONCRETE CURBS AND WALKS**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of Contract apply to work of this Section.

#### **1.2 DESCRIPTION OF WORK**

- A. General: Furnish all labor and materials to construct concrete curbs and gutters, sidewalks including ramps, and driveways as called for in the Drawings and detailed in the Standard Detail Drawings to include excavation and backfill; foundation; and forming, placing, jointing, form removing, finishing and curing concrete.

### **PART 2 - MATERIALS**

- 2.1 Concrete: FDOT 345-2 (except no pozzolan), 4, 6, 9, 10, 11, 12, 13. Class I concrete with minimum 28-day compressive strength of 3000 psi.
- 2.2 Reinforcement: ASTM A615 - Grade 60.
- 2.3 Joint Materials: FDOT 932-1.
- 2.4 Membrane Curing Compound: FDOT 925-2.
- 2.5 Forms: Forms shall be metal or wooden, straight, and free from warp or bends and of sufficient strength, when staked to resist the pressure of the concrete without deviation from line and grade. Flexible forms shall be used for all items constructed on a radius.

### **PART 3 - EXECUTION**

- 3.1 Foundation (Subgrade Preparation): The subgrade shall be excavated or filled with suitable material to the required grades and lines. All soft, yielding, and otherwise unsuitable material shall be removed and replaced with suitable material. Filled sections shall be compacted to a minimum of 95% of maximum (AASHTO T-180) density and extend to a minimum of 1 foot outside the form lines. The subgrade shall be dense, firm, trimmed to a uniform smooth surface, and in a moist condition when the concrete is placed.
- 3.2 Machine Laid Curb: The slipform/extrusion machine approved shall be so designed as to place a spread, consolidate, screed, and finish the concrete in one complete pass in such a manner that a minimum of hand finishing will be necessary to provide a dense and homogeneous concrete section. The machine shall shape, vibrate, and/or extrude the concrete for the full width and depth of the concrete section being placed. It shall

- be operated with as nearly a continuous forward movement as possible. All operations of mixing, delivery, and spreading concrete shall be so coordinated as to provide uniform progress, with stopping and starting of the machine held to a minimum.
- 3.3 Forming: Depth of forms shall be equal to the Drawing dimensions for the concrete to be placed against them. Forms shall be staked to resist the pressure of the concrete without deviation from line and grade. They shall be cleaned each time used and shall be oiled or saturated with water prior to placing concrete.
- 3.4 Reinforcement: Reinforcement shall only be required where called for in the Drawings. Set reinforcement for sidewalks above the foundation so concrete will flow under it.
- 3.5 Placing: Place concrete in the forms and tamp and spade to prevent honeycomb until the top of the structure can be floated smooth. Round all edges to 1/2 inch radii unless otherwise shown on the Standard Detail Drawings.
- 3.6 Sidewalk Ramps: Ramps shall be provided at all road/street crossings each way as shown in the Standard Detail Drawings.
- 3.7 Contraction Joints: Unless otherwise shown or noted in the Drawings, weakened plane contraction joints shall be located as follows:
- Curbs - 10 feet maximum intervals.
- Sidewalks - To form squares of uniform size.
- 3.8 Contraction joints may be sawed, hand-formed, or made by 1/8 inch thick division plates in the framework. Sawing shall be done early after the concrete has set to prevent the formation of uncontrolled cracking. The joints may be hand-formed by using a narrow or triangular jointing tool or a thin metal blade to impress a plane of weakness into the plastic concrete. Where division plates are used, the plates shall be removed after the concrete has set and while the forms are still in place.
- 3.9 Expansion (Isolation) Joints: Provide isolation joints between all distinct structures such as between sidewalk and curbs, driveway and sidewalk or curbs, sidewalk or curbs and inlets, around concrete utility poles and at radius points along the curbs and at the end of a continuous pour.
- 3.10 Finishing: Strike off concrete sidewalks and driveways by means of a wood or metal screed, used perpendicular to the forms, to obtain required grade and remove surplus water laitance. Broom finish the surfaces and finish edges with an edging tool having a radius of 1/2 inch.
- 3.11 Remove all curb and gutter forms within 24 hours after concrete is in place, and fill minor defects with mortar composed of one part portland cement and two parts fine aggregate. Plastering is not permitted. Finish all curbs and gutter surfaces while the

cement is still green to a brush finish. For any surface areas that are too rough or where surface defects make additional finishing necessary, the curb shall be rubbed to a smooth surface with a soft brick or wood block, with water used liberally.

3.12 Surface Requirements: Test the gutters with a 20 foot straight edge laid parallel to the centerline of the roadway while the concrete is still plastic. Straight edging shall be done along the edge of the gutter adjacent to the pavement or along other lines on the gutter cross-section. Irregularities in excess of 1/4 inch shall be corrected immediately. Surface variations on sidewalks and driveways shall not exceed 1/4 inch under a 10 foot straight edge, nor more than 1/8 inch on a 5 foot traverse section.

3.13 Curing: Concrete shall be cured by the Membrane Curing Compound Method for a continuous period of 72 hours minimum, commencing after completing the finishing and as soon as the concrete has hardened sufficiently to permit application of the curing material without marring the surface. Immediately replace any curing material that may be removed or damaged during the 72-hour period.

This method requires the application of a clean membrane curing compound or white pigmented curing compound as in the Membrane Curing Compound paragraph above, by a hand sprayer in a single continuous film with uniform coverage of at least one gallon to each 200 square feet. Any cracks, check or other defects shall be recoated immediately. Agitate the curing compound thoroughly in the drum prior to application, and during application as necessary to prevent settlement of the pigment.

3.14 Backfilling and Compaction: After the concrete has set sufficiently, but no later than 3 days after the pouring, the spaces in front and back of the curb and other excavation generated from this work shall be refilled to the required elevation with suitable material, placed and thoroughly compacted in layers not to exceed 6 inches.

3.15 Protection: The Contractor shall always have materials available to protect the surface of the plastic concrete against rain. These materials shall consist of waterproof paper or plastic sheeting. For slipform construction, materials such as wood planks or forms to protect the edges shall also be required.

3.16 Testing: Provide not less than three 6 inches by 12 inches cylinder compressive strength tests (ASTM C 39) and one slump test (ASTM C 143) for each 75 cubic yards of part thereof poured.

END OF SECTION

## **SECTION 02666 - POTABLE WATER SYSTEMS**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of Contract apply to work of this Section.

#### **1.2 DESCRIPTION OF WORK**

- A. Extent of potable water systems work is indicated on drawings and schedules, and by requirements of this section.
- B. Refer to Division-2 Section "EARTHWORK - UNDERGROUND UTILITIES" for excavation and backfill required for potable water systems; not work of this section.
- C. Refer to Division-15 Section "POTABLE WATER SYSTEMS" for interior building systems including interior piping, fixtures, and equipment; not work of this section.

#### **1.3 QUALITY ASSURANCE**

- A. **Manufacturer's Qualifications:** Firms regularly engaged in manufacturer of potable water systems materials and products, of types and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.
- B. **Installer's Qualifications:** Firm with at least 3 years of successful installation experience on projects with potable water piping work similar to that required for project.
- C. **Codes and Standards:**
  - 1. AWWA C-600 for Ductile Iron and install PVC as applicable.
  - 2. AWWA C-900 for PVC pipe 4 inch to 12 inch.
  - 3. **Water Purveyor Compliance:** Comply with requirements of Purveyor supplying water to project, obtain inspections from Purveyor as outlined in this section.

#### **1.4 SUBMITTALS**

- A. **Product Data:** Submit manufacturer's technical product data and installation instructions for potable water system materials and products.
- B. **Shop Drawings:** Submit shop drawings for potable water systems, showing piping materials, size, locations, and elevations. Include details of underground structures, connections, thrust blocks, and anchors. Show interface and spatial relationship between piping and proximate structures.

- C. Record Drawings: At project closeout, submit record drawings of installed potable water system piping and products, in accordance with requirements of Division-1.
- D. Maintenance Data: Submit maintenance data and parts lists for potable water system materials and products. Include this data, product data, shop drawings, and record drawings in maintenance manual; in accordance with requirements of Division-1, if applicable.

## PART 2 - PRODUCTS

### 2.1 IDENTIFICATION

- A. Underground-Type Plastic Line Markers: Manufacturer's standard permanent, bright-colored, continuous-printed plastic tape, intended for direct-burial service; not less than 6 inches wide x 4 mils thick. Provide blue tape with black printing reading "CAUTION WATER LINE BURIED BELOW."
  - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering plastic line markers which may be incorporated in the work include, but are not limited to, the following:
    - a. Allen Systems Inc.
    - b. Seton Name Plate Corp.
    - c. or approved equal
- B. Nonmetallic Piping Label: If nonmetallic piping is used for water service, provide engraved plastic laminate, label permanently affixed to main electrical meter panel stating "This structure has a nonmetallic water service."

### 2.2 PIPES AND PIPE FITTINGS

- A. General: Provide piping materials and factory-fabricated piping products of sizes, types, pressure ratings, and capacities as indicated. Provide sizes and types matching piping and equipment connections; provide fittings of materials which match pipe materials used in potable water systems.
- B. Piping: Provide pipes of one of the following materials, of weight/class indicated.
- C. Iron Pipe & Fittings: Pipe shall be ductile iron (DI) with minimum thickness of Class 51 for 3 and 4 inch diameter pipe and Class 50 for larger pipe. Fittings may be ductile iron or gray iron (GI) with pressure rating equal to that of the pipe unless otherwise specified in the Drawings. The materials shall be as follows:
  - 1. Pipe - ANSI A21.51 (AWWA C151)
  - 2. Fittings - ANSI A21.10 (AWWA C110)
  - 3. Joints - Mechanical & Push-on, ANSI A21.11 (AWWA C111)
  - 4. Joints - Flanged ANSI A21.10 & A21.15 (AWWA C110 & C115) Class 125 and 1/8 inch full faced rubber gaskets.

5. Restrained joints - Ductile iron mechanical joint retainer glands approved equal to American Cast Iron Pipe Co.
  6. Flexible joints - Boltless with 15 joint deflection per applicable portions of ANSI A21.10 (AWWA C110) approved equal to "Flex-Lok" by American Cast Iron Pipe Co.
  7. Bolts & Nuts - Bolts, ANSI B18.21; Nuts, B18.2.1; low carbon steel per ASTM A307, Grade B.
- D. Coatings, Linings & Encasement (Iron Pipe): All pipe and fittings shall be cement mortar lined per ANSI A21.4 (AWWA C104) and bituminous coated per above.
1. Where protective interior lining is called for, use 20 mil (minimum dry thickness) virgin polyethylene per ASTM D1248 compounded with an inert filler and with sufficient carbon black to resist ultraviolet rays during above ground storage, heat bonded to pipe and fittings, approved equal to "Polybond" by American Cast Iron Pipe Company.
  2. Polyethylene Encasement, where required, shall be per ANSI A21.5 (AWWA C105).
  3. Pipe fittings scheduled for field painting shall not receive an exterior bituminous coating. Instead, the pipe and fitting exterior shall be cleaned thoroughly and given one (1) shop coat of rust-inhibitive primer compatible with the field paint applied in accordance with the manufacturer's recommendations.
  4. Machined surfaces shall be cleaned and coated with a suitable rust-preventative coating at the shop immediately after machining.
- E. Polyvinyl Chloride Pipe (PVC): 4 inch to 12 inch AWWA C900, DR-18 National Sanitation Foundation (NSF) approved for potable water having integral wall-thickened bell ends without increase in DR and outside diameter equivalent to ductile iron pipe. Use iron fitting per above. Joints shall be elastomeric seals per ASTM D3139 and ASTM F477. Lubrication shall be non-toxic, NSF approved for potable water. Polyvinyl chloride pipe less than 4 inches shall be in accordance with ASTM 1785 for schedule 40, 80, 120 or ASTM 2241 for SDR21, minimum PC 200.
- F. Check Valves: Iron body, bronze-mounted, stainless steel hinge pin, outside spring operated, swing non-slam type, and equipped with removable inspection covers. Units shall be rated for 150 psi minimum working pressure and shall permit full flow area equal to that of the connecting pipe. Approved equal to M & H.
- Valves 2 inches and smaller - bronze body and disc, swing check type, with removable inspection covers, rated at 150 psi minimum working pressure, equal to Crane No. 37.
- G. Valve Boxes: Cast iron, adjustable, with minimum interior diameter of 5 inches. The word "Water" shall be legibly cast into the cover. Boxes to conform to applicable surface loading and valve size approved equal to Clow.
- H. Valves-General: The manufacturer shall clearly mark the valve type, size, rating and flow direction arrow. Valves shall open to the left (counter-clockwise) with an arrow cast in the metal of the operating handwheels and nuts indicating the direction of opening.



Above ground installations shall have flanged joints; below ground shall be mechanical joints.

- I. Gate Valves: Iron body, bronze-mounted double disc, O-ring seal, per AWWA C500. Valves for underground service shall be non-rising stem (NRS) type equipped with 2 inch square cast iron wrench nuts. Valves for above ground service shall be outside screw and yoke (OS & Y) rising stem type equipped with cast iron band wheels or chain operators with galvanized steel chains as noted in the Drawings.
  - 1. Tapping valves - per the above, compatible with the connecting sleeve or saddle and specially designed for wet tapping installations.
  - 2. Actuators - Equip all valves 16-inch and larger with approved gearing actuators, with sealed enclosures for buried or submerged service, and shall be furnished by the valve manufacturer. Position indicators as required.
  - 3. Horizontal Installation - Valves 16-inches in diameter or larger, to be installed horizontally, shall be additionally equipped per the applicable Section of AWWA C500 and as follows:
    - a. Installed in vertical pipe with horizontal stem-fitted with approved slides, tracks and shoes to assist the travel of the gate assembly.
    - b. Installed in Horizontal pipe with horizontal stem - equipped with approved rollers, tracks and scrapers to assist the travel of the gate assembly and to clear the tract of obstructions.
  - 4. Valves 3-inches and smaller - Bronze, wedge disc, non-rising stem type, 150 psi minimum working pressure, equipped with wrought steel or cast iron operating handwheels, approved equal to Crane No. 437.
- J. Butterfly Valves: Cast iron body, allow cast or ductile iron disc, body mounted at seat, one-piece stainless steel shaft, short or long body type, AWWA C504, with the valve class, shaft size and other special requirements selected in accordance with the specific design, "Rubber-Seated Butterfly Valves". Valve operation by approved gear actuators, with sealed enclosures for buried or submerged service. Position indicators furnished as required. Equip units with actuating nuts, cast iron handwheels or chain operators, with galvanized steel chains for the given installation. All appurtenances furnished by valve manufacturer.
- K. Backflow Prevention Device: Type and manufacturer shown in the Drawings, otherwise per AWWA C-506, however the device shall be acceptable to the local jurisdiction. Approved equal to Hersey (Beeco), CLa-Val, Febco, Grinnel.
- L. Meter Box: Cast-iron or concrete standard types, appropriately sized for utilization and installation requirements.
- M. Expansion Joints: Pipe expansion joints shall be minimum 150 psi working pressure equal to style N. 500, manufactured by Mercer Rubber Company.

- N. Flanged Coupling Adapters: Equal to Smith Blair Type 912 for pipe size to 12 inches and Type 913 for larger sizes. Conformance with ANSI Standard B16.1 (125 lb flanges).
- O. Cast Couplings: Equal to Smith Blair, Type 431 (connecting equal outside diameter pipes), Type 433 (connecting equal size pipes with variations in outside diameter), and Type 435 (reducing coupling).
- P. Cast Iron Sleeves and Wall Pipes: Shall have integral annular ring water-stops, and conform to requirements for Cast Iron fittings noted herein. Sleeves and Wall Pipes to have laying length and ends required for proper installation.
- Q. Tapping Saddles: Ductile Iron, suitable for either wet or dry installation double strapped as manufactured by the American Cast Iron Pipe Company. Provide an "O"-ring type sealing gasket. Provide tie straps and bolts of a corrosive resistant alloy steel.
- R. Tapping Sleeves and Crosses: mechanical joint type, with outlet flange ANSI B16-1, 125 lb standard, approved equal to M & H.
- S. Service Saddle: Double strap units with straps of corrosion resistant alloy steel and "O"-ring type sealing gasket. Ductile iron for ductile iron pipe, equal to Smith Blair Type 3.3. Type 342 or 352 for plastic pipe.
- T. Service Line Materials: AWWA C800 and the Appendix thereto where applicable. The minimum pressure class for plastic piping/tubing shall be 200 psi.
- U. Concrete: FDOT 345 - 2, 4, 6, 9, 10, 11, 12 and 23. Class II concrete, minimum 28 day compression strength of 3400 psi.

### 2.3 ACCESSORIES

- A. Anchorages: Provide anchorages for tees, wyes, crosses, plugs, caps, bends, valves, and hydrants. After installation, apply full coat of asphalt or other acceptable corrosion-retarding material to surfaces of ferrous anchorages.
  - 1. Clamps, Straps, and Washers: Steel, ASTM A 506.
  - 2. Rods: Steel, ASTM A 575.
  - 3. Rod Couplings: Malleable-iron, ASTM A 197.
  - 4. Bolts: Steel, ASTM A 307.
  - 5. Cast-Iron Washers: Gray-iron, ASTM A 126.
  - 6. Thrust Blocks: Concrete, 3,000 psi, as indicated on drawings.
- B. Yard Hydrants: Provide non-freeze yard hydrants, 3/4 inch inlet, 3/4 inch hose outlet, bronze casing, cast-iron or cast-aluminum casing guard, key-operated, and tapped drain port in valve housing.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering yard hydrants which may be incorporated in the work include, but are not limited to, the following:
  - a. Josam Mfg. Co.
  - b. Smith (Jay R.) Mfg. Co.
  - c. Tyler Pipe.
  - d. Zurn Industries, Inc.; Hydromechanics Div.

## 2.4 FIRE HYDRANTS

- A. AWWA C502, and shall be equipped with a minimum of one pumper outlet nozzle 4-1/2 inches in diameter and two hose nozzles 2-1/2 inches in diameter. Paint hydrant with two coats of oil paint using the local color code based on fire flow tests. Threads, nozzle caps, operating nuts and color shall conform to requirements of the local jurisdiction. Units shall be traffic type with breakable safety clips, or flange, and stem, with safety coupling located below barrel break line to preclude valve opening. Hydrants shall be dry top, low profile design with a maximum height of 30 inches. Outlet nozzles shall be on the same plane, with minimum distance of 18 inches from center of nozzles to ground line. Valve shall be compression type with 5-1/2 inches minimum opening and shoe inlet connection to be 6 inches minimum.

## PART 3 - EXECUTION

### 3.1 INSPECTION

- A. General: Examine areas and conditions under which potable water system's materials and products are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

### 3.2 INSTALLATION OF IDENTIFICATION

- A. General: During back-filling/top-soiling of underground potable water piping, install continuous underground-type plastic line markers, located directly over buried lines at 24 inches below finish grade.
- B. Insulation: Insulate all above ground piping for freeze protection.
- C. Pipe Laying: Lay all pipe "in the dry" along straight lines and grades between fittings, manholes, or other defined points, unless definite alignments deflections or grade changes are noted in the Drawings. Maintain a 3 foot minimum depth of cover over the top of pipe, unless otherwise noted in the Drawings. Maintain all materials, clean and protect all coatings from damage. Maintain the interior of the pipe, clean and free of dirt and debris. When work is not in progress, plug all open ends. Underground piping shall not be driven to grade by striking it with an unyielding object. Provide bell holes in the bedding to allow uniform load bearing along the pipe barrel.

Subaqueous pipe laying may be permitted with prior approval of the Engineer where conditions make it impracticable to lay pipe "in the dry".

Provide proper provisions for pipe expansions or contraction by installing expansion joints or other suitable methods. Also provide flexible connections to expedite equipment or piping system removal.

- D. Push-On Joints: The pipe bell and spigot shall be thoroughly cleaned immediately prior to inserting the gasket and jointing. Assure that the gasket is properly faced and positioned. Lubricate in accordance with manufacturer's recommendations. Protect pipe against damage from jointing equipment by using timber headers, etc.
- E. Mechanical Joints: Wipe clean the socket and plain end. The plain end, socket, and gasket shall be washed with a soap solution immediately prior to jointing. Maintain the joint straight during assembly with the gasket pressed firmly and evenly into the recess. Bolts shall be tightened such that the gland remains reasonable parallel to the flange by alternating from bolt to bolt in cycles. The required bolt size (pipes 4 inch to 24 inch diameter) is 3/4 inch torqued to 75 - 90 ft-lbs.
- F. Flange Joints: Make all flanged joints tight, without applying undue strain upon the joint or other appurtenances. Fit joints such that contact surfaces bear uniformly on the gasket with relatively uniform bolt stresses.
- G. Pipe Cutting: Cutting pipe for the insertion of valves, fittings, or closure pieces shall be done in a neat workmanlike manner without damaging pipe, coatings or linings. Cut the pipe with an abrasive pipe saw, rotary wheel cutter, guillotine pipe saw or milling wheel saw, and per manufacturer's recommendations. Cut ends and rough edges shall be ground smooth, and for push-on joint connections the cut end shall be beveled.
- H. Pipe Restraint: All plugs, caps, tees, and bends, unless otherwise specified, shall be restrained by thrust block reaction backing and/or the use of tie rods, retainer glands and/or restrained joints as shown in the Drawings and Standard Detail Drawings. Thrust blocking shall be placed between solid ground and the fitting to be anchored. Where concrete is to be placed around bolted joints, provide a sheet of 3 mil (minimum) polyethylene between the fitting and the concrete. Where soil bearing is inadequate to provide proper thrust blocking, Contractor shall provide mechanical restraint as directed by the Engineer. Protect tie rods, clamps, or other components of dissimilar metal against corrosion by hand application of a bituminous coating. Backfilling over pipe restraints shall not proceed until inspected by the Engineer.
- I. Polyethylene Encasement: When polyethylene encasement is specified for ductile iron pipe it shall be installed in accordance with ANSI A21.5 (AWWA C105).

- J. Support of Exposed Pipework: Support exposed systems as necessary to hold the piping and appurtenances in a firm, substantial manner to the required line and grades indicated on the Drawings, with no undue piping stresses transmitted to equipment or other items. Support all piping in buildings from the floors, wall, ceiling and beams adequately. Supports from the floor shall be by suitable saddle stands or piers. Support piping along walls by wall brackets, saddles or by wall brackets with adjustable hanger rods. When piping is supported from the ceiling, use approved rod hanger of a type capable of screw adjustment after erection. Support all pipe above ground outside of buildings by concrete supports.

Where floor stands and extension stems are required for exposed valves, furnish adjustable wall bracket and extension stems. In general, brackets shall be not more than 6 feet apart, with floorstands and guides set firmly in concrete.

- K. Tapping: Tapping shall be by tapping sleeve (or cross) and valve installed with a tapping device designed for the pipe material.
- L. Service Connections: All connections less than 1 2-inches are considered service connections. New services shall be no less than 3/4-inches in diameter, unless noted otherwise on the drawings. Service lines serving a double connection shall be no less than 1-inch in diameter, unless noted on the drawings. Connection to main 4-inch and larger shall be by drilling the appropriate size hole and installation of service saddle with services to smaller mains by means of in-line fittings. Place a corporation stop at the saddle or fitting, extend service line to property line (perpendicular from the Main), and terminate with a plugged curb-stop pending meter installation. The contractor shall mark the location of each water service at its upper end by chiseling a letter "W" - 1 2-inches high on the top of the curb. If the curb does not exist, place a 4" x 4" x 3'-0" wood stake extending 2-inches above the ground at the end of the service.
- M. Valves: Carefully inspect all valves, opened wide, and then tightly closed, and all the various nuts and bolts for tightness. Take special care to prevent joint materials, stones, and other substances from becoming lodged in the valve seat. Any valve that does not operate correctly shall be replaced. Install at the locations, to the sizes, and elevations called for in the Drawings. Install buried valves vertically centered over the pipe. Provide extension stems on all buried valves to place the operating nut not more than 3 feet below grade.
- N. Valve Boxes: Center all valve boxes over the operating nut of underground valves to permit a valve wrench to be easily fitted to the nut. Set top of boxes to final grade. The valve box shall not transmit surface loads directly to either the pipe or valve. Use excessive care to prevent earth and other materials from entering the boxes. Any valve box that becomes out of alignment or is not to grade, shall be dug out and adjusted. A concrete collar shall be provided as shown in the Drawings.

### 3.3 FIELD QUALITY CONTROL

A. Piping Tests: Conduct piping tests before joints are covered, and after thrust blocks have sufficiently hardened. Fill pipeline 24- hrs prior to testing, and apply test pressure to stabilize system. Use only potable water.

B. Hydrostatic Tests: Test at not less than 150 psi for 2 hours.

This test shall be performed by the Contractor with his labor and equipment in the presence of the Engineer and Owner/Purveyor Representative. No testing will proceed until all thrust blocks are cured or restraining devices installed. Clean and flush all piping thoroughly prior to testing. During filling of water all air will be carefully permitted to escape through release cocks installed as required.

$$L = \frac{(N) (D) (P)^2}{3700} = \text{allowable leakage in gallons per 2 hour test.}$$

L = 0.00331 ND; for 150 psi test for 2 hours.

N = Number of joints in the section tested.

D = Nominal pipe diameter in inches.

P = Average test pressure maintained during the leakage test in psig (gauge).

During the two (2) hour period of the test, the Contractor shall maintain a continuous pressure of 150 psi, by means of a pump taking supply from a container suitable for the measurement of water loss. Should the test fail, the leak will be located and repaired and the test performed again until it meets the above specified limits.

C. Disinfection - Following the hydrostatic leakage test, Contractor shall provide all labor and materials to disinfect all sections of water systems, and receive approval from the appropriate agencies before placing the system in service. Disinfection shall be performed per AWWA C651 and Florida Department of Environmental Protection requirements.

D. Chlorination - Apply the chlorination agent at the beginning of the section adjacent to the feeder connection, by injecting it through a corporation cock, hydrant or other connection ensuring treatment of the entire system. The chlorination agent may be any compound specified in AWWA C651. Feed water slowly into the new line and induce chlorine to produce a dosage and a residual as a dosage of between 40-50 ppm and a residual of not less than 25 mg/1 in all parts of the line after a 24-hour time period. During the chlorination process operate all valves and accessories.

E. Flushing - Flush the system carefully until the chlorine concentration in the discharged water is equal to that generally prevailing or less than 1mg/1.

- F. Bacteriological Testing - After disinfecting the system, Contractor shall have samples collected for bacteriological analysis and submit as directed by Florida Department of Environmental Protection or local governing authority.
- G. Inspection of Work - All work is subject to inspection by the Water Purveyor, Owner's Representative and Engineer. The following phases of construction shall be inspected by the Owner's Representative and Engineer:

- Placing of pipe, fittings and appurtenances.
- Hydrostatic Test
- Backfill
- Sterilization
- Placing in Service

END OF SECTION

## **SECTION 02668 - FIRE WATER SYSTEMS**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of Contract apply to work of this Section.

#### **1.2 DESCRIPTION OF WORK**

- A. Extent of fire water systems work is indicated on drawings and schedules, and by requirements of this section.
- B. Refer to Division-2 section "EARTHWORK/UNDERGROUND UTILITIES" for excavation and backfill required for fire water systems; not work of this section.
- C. Refer to Division-3 sections for concrete work required for fire water systems; not work of this section.
- D. Refer to Division-15 section "FIRE PROTECTION" for interior building systems including sprinklers and standpipes; not work of this section.

#### **1.3 QUALITY ASSURANCE**

- A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of fire water system's products of types, materials, and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.
- B. Installer's Qualifications: Firm with at least 3 years of successful installation experience on projects with fire water work similar to that required for project.
- C. Codes and Standards:
  - 1. NFPA Compliance: Install fire water systems in accordance with NFPA 24 "Standard for the Installation of Private Fire Service Mains and Their Appurtenances."
  - 2. Local Fire Department/Marshal Regulations: Comply with governing regulations pertaining to hydrants, including hose unit threading and similar matching of connections.
  - 3. UL Compliance: Provide fire hydrants that comply with UL 246 "hydrants for fire protection service" and are listed by UL.

#### **1.4 SUBMITTALS**

- A. Product Data: Submit manufacturer's technical product data and installation instructions for fire water system materials and products.
- B. Shop Drawings: Submit shop drawings for fire water systems, showing piping



- materials, size, locations, and elevations. Include details of underground structures, connections, thrust blocks, and anchors. Show interface and spatial relationship between piping and proximate structures.
- C. Record Drawings: At project closeout, submit record drawings of installed fire water system piping and products, in accordance with requirements of Division-1.
  - D. Maintenance Data: Submit maintenance data and parts lists for fire water system materials and products. Include this data, product data, shop drawings, and record drawings in maintenance manual; in accordance with requirements of Division-1, if applicable.

## PART 2 - PRODUCTS

### 2.1 IDENTIFICATION

- A. Underground-Type Plastic Line Marker: Manufacturer's standard permanent, bright-colored, continuous-printed plastic tape, intended for direct-burial service; not less than 6 inches wide x 4 mils thick. Provide blue tape with black printing reading "CAUTION WATER LINE BURIED BELOW."
  - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering identification markers which may be incorporated in the work include, but are not limited to, the following:
    - a. Allen Systems Inc.
    - b. Seton Name Plate Corp.

### 2.2 PIPES AND PIPE FITTINGS

- A. General: Provide piping materials and factory-fabricated piping products of sizes, types, pressure ratings, temperature ratings, and capacities as indicated. Provide materials and products complying with NFPA 24 where applicable. Provide sizes and types matching piping and equipment connections; provide fittings of materials which match pipe materials used in fire water piping systems. Where more than one type of materials or products are indicated, selection is Installer's option.
  - 1. Iron Pipe & Fittings: Pipe shall be ductile iron (DI) with minimum thickness of Class 51 for 3 and 4 inch diameter pipe and Class 50 for larger pipe. Fittings may be ductile iron or gray iron (GI) with pressure rating equal to that of the pipe unless otherwise specified in the Drawings. The materials shall be as follows:
    - a. Pipe: - ANSI A21.51 (AWWA C151)
    - b. Fittings - ANSI A21.10 (AWWA C110)
    - c. Joints - Mechanical & Push-on, ANSI A21.11 (AWWA C111)
    - d. Joints - Flanged ANSI A21.10 & A21.15 (AWWA C110 & C115)  
Class 125 and 1/8 inch full faced rubber gaskets.
    - e. Restrained Joints: - Ductile iron mechanical joint retainer glands approved equal to American Cast Iron Pipe Co.

- f. Flexible Joints - Boltless with 15 joint deflection per applicable portions of ANSI A21.10 (AWWA C110) approved equal to "Flex-Lok" by American Cast Iron Pipe Co.
  - g. Bolts & Nuts - Bolts, ANSI B18.21; Nuts, B18.2.1; low carbon steel per ASTM A 307, Grade B.
2. Polyvinyl Chloride Pipe (PVC): 4 inch to 12 inch AWWA C900, Class 150, having integral wall-thickened bell ends without increase in DR and outside diameter equivalent to ductile iron pipe. Use iron fitting per above. Joints shall be elastomeric seals per ASTM D 3139 and ASTM F 477. Lubrication shall be non-toxic, NSF approved for potable water. Polyvinyl chloride pipe less than 4 inches shall be Schedule 40, unless otherwise noted on construction drawings.
  3. Coatings, Linings & Encasement (Iron Pipe): All pipe and fittings shall be cement mortar lined per ANSI A21.4 (AWWA C104) and bituminous coated per above.  
  
Where protective interior lining is called for, use 20 mil (minimum dry thickness) virgin polyethylene per ASTM D 1248 compounded with an inert filler and with sufficient carbon black to resist ultraviolet rays during above ground storage, heat bonded to pipe and fittings, approved equal to "Polybond" by American Cast Iron Pipe Company.  
  
Polyethylene Encasement, where required, shall be per ANSI A21.5 (AWWA C105).
  4. Pipe fittings scheduled for field painting shall not receive an exterior bituminous coating. Instead, the pipe and fitting exterior shall be cleaned thoroughly and given one (1) shop coat of rust-inhibitive primer compatible with the field paint applied in accordance with the manufacturer's recommendations.
  5. Machined surfaces shall be cleaned and coated with a suitable rust-preventative coating at the shop immediately after machining.

### 2.3 VALVES

- A. Gate Valves: Provide gate valves, UL-listed, 175 psi working pressure for 12 inches and smaller, 150 psi for sizes larger than 12 inches. Provide threaded, flanged, hub, or other end configurations to suit size of valve and piping connection. Provide inside screw type for use with indicator post, iron body bronze mounted, non-rising stem, solid wedge disc.
  1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering gate valves which may be incorporated in the work include, but are not limited to, the following:  
  
American Valve Mfg. Corp.  
American-Darling Valve; Div. of American Cast Iron Pipe Co.  
Clow Corp.; Valve Div.

- Fairbanks Co.
  - Kennedy Valve; Div. of ITT Grinnell Valve Co., Inc.
  - Stockham Valves & Fittings Inc.
  - United Brass Works Inc.
  - United States Pipe and Foundry Co.
  - Waterous Co.
  - Mueller Co.
- B. Indicator Posts: Provide indicator posts, UL-listed, designed for use with underground gate valves to provide aboveground means for operating valves and indicating position of valves. Provide telescopic barrel type with indicating target, intended for use with gate valves 4 inches through 14 inches, with operating wrench.
1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering indicator posts which may be incorporated in the work include, but are not limited to, the following:
- American-Darling Valve; Div. of American Cast Iron Pipe Co.
  - Clow Corp.; Valve Div.
  - Eddy-Iowa; Div. Clow Corp.
  - Fairbanks Co.
  - Grinnell Fire Protection Systems Co., Inc.
  - Kennedy Valve; Div. of ITT Grinnell Valve Co., Inc.
  - Mueller Co.
  - Standard Fire Protection Co.
  - Stockham Valves & Fittings Inc.
  - United States Pipe and Foundry Co.
  - Waterous Co.
- C. Butterfly Valves: Provide butterfly valves, UL-listed, 175 psi working pressure for 2 inches through 12 inches, 150 psi for sizes larger than 12 inches. Provide gear actuator and position indicator.
1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering butterfly valves which may be incorporated in the work include, but are not limited to, the following:
- Demco; Div. of Cooper Industries Inc.
  - ITT Grinnell; Div. of ITT Industries of Canada Ltd.
  - Kennedy Valve; Div. of ITT Grinnell Valve Co., Inc.
  - Keystone Valve; Div. of Keystone International Inc.
  - Nibco Inc.
  - Powell (Wm.) Co.
  - Pratt (Henry) Co.
  - Tomoe Valve Co. Ltd.
  - Mueller Co.
- D. Check Valves: Provide check valves as indicated, UL-listed, 175 psi working pressure for 2 inches through 12 inches, 150 psi for sizes larger than 12 inches. Provide swing type, iron body bronze mounted with metal- to-metal or rubber-faced checks. Provide threaded, flanged, or hub end, to suit size and piping connections.
1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering check valves which may be incorporated in the work

include, but are not limited to, the following:

American-Darling Valve; Div. of American Cast Iron Pipe Co.  
Clow Corp.; Valve Div.  
Fairbanks Co.  
Kennedy Valve; Div. of ITT Grinnell Valve Co., Inc.  
Mueller Co.  
Nibco Inc.  
Stockham Valves & Fittings Inc.  
Walworth Co.  
Waterous Co.

- E. Detector Check Valves: Provide detector check valves as indicated, UL listed, 175 psi working pressure. Provide iron or brass bodied with weighted clapper and provisions for connection of by-pass meter around check.
1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering detector check valves which may be incorporated in the work include, but are not limited to the following:

Ames Co., Inc.  
Central Sprinkler Corp.  
Firematic Sprinkler Devices Inc.  
Globe Fire Equipment Co.  
Hersey Products Inc.  
Kennedy Valve; Division of ITT Grinnell Valve Co., Inc.  
Mueller Co.  
Reliable Automatic Sprinkler Co., Inc.  
Viking Corp.

- F. Fire Hydrant: AWWA C502, and shall be equipped with a minimum of one pumper outlet nozzle 4-1/2 inches in diameter and two hose nozzles 2-1/2 inches in diameter. Paint hydrant with one coat of red-lead and two coats of oil point using the local color code based on fire flow tests. Threads, nozzle caps, operating nuts and color shall conform to requirements of the local jurisdiction. Units shall be traffic type with breakable safety clips, or flange, and stem, with safety coupling located below barrel break line to preclude valve opening. Hydrants shall be dry top, low profile design with a maximum height of 30 inches. Outlet nozzles shall be on the same plane, with minimum distance of 18 inches from center of nozzles to ground line. Valve shall be compression type with 5-1/2 inches minimum opening and shoe inlet connection to be 6 inch minimum.

## 2.4 ACCESSORIES

- A. Anchorages: Provide anchorages for tees, wyes, crosses, plugs, caps, bends, valves, and hydrants. After installation, apply full coat of asphalt or other acceptable corrosion-retarding material to surfaces of ferrous anchorages.
1. Clamps, Straps, and Washers: Steel, ASTM A 506.  
2. Rods: Steel, ASTM A 575.  
3. Rod Couplings: Malleable-iron, ASTM A 197.  
4. Bolts: Steel, ASTM A 307.  
5. Cast Iron Washers: ASTM A 126.

6. Thrust Blocks: As Indicated on Drawings.

- B. Valve Pits: Provide valve pits as indicated, constructed of poured-in-place or precast concrete. Construct of dimensions indicated with manhole access, ladder, and drain. Provide sleeves for pipe entry and exit; provide waterproof sleeve seals. If valve pit not below water table, provide open bottom filled with 3/4 gravel.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION OF IDENTIFICATION

- A. General: During back-filling/top-soiling of underground fire water piping systems, install continuous underground-type plastic line marker, located directly over buried line at 24 inches below finished grade.

#### 3.2 INSTALLATION OF PIPE AND PIPE FITTINGS

- A. Ductile-Iron Pipe: Install in accordance with AWWA C600 "Standard for Installation of Ductile-Iron Water Mains and Their Appurtenances."
- B. Polyvinyl Chloride Pipe: Install in accordance with manufacturers's installation instructions.
- C. Steel Pipe: Install in accordance with AWWA M11 "Steel Pipe-Design and Installation."
- D. Depth of Cover: Provide minimum 36 inches depth of cover over underground piping in accordance with NFPA 24, Figure A-8-11 "Recommended Depth of Cover Above Top of Underground Yard Mains."

#### 3.3 INSTALLATION OF VALVES

- A. General: Install valves as indicated. Provide post indicator for control valves.
- B. Control Valves: Install post indicator valve at each connection into building, locate 40 ft. from building's outside wall, or as indicated.
- C. Shutoff Valves: Install shutoff valve ahead of each hydrant.

#### 3.4 INSTALLATION OF HYDRANTS

- A. General: Install fire hydrants in accordance with AWWA M17 "Installation, Operation, and Maintenance of Fire Hydrants."
- B. Location: Install fire hydrants minimum of 40 feet-0 inches from building's outside wall, or as indicated.

#### 3.5 FIELD QUALITY CONTROL

- A. Piping Tests: Conduct piping tests before joints are covered, and after thrust blocks have sufficiently hardened. Fill pipeline 24-hrs prior to testing, and apply test pressure to stabilize system. Use only potable water.

B. Hydrostatic Tests: Test at not less than 200 psi for 2 hours.

1. This test shall be performed by the Contractor with his labor and equipment in the presence of the Engineer. No testing will proceed until all thrust blocks are cured or restraining devices installed. Clean and flush all piping thoroughly prior to testing. During filling of water all air will be carefully permitted to escape through release cocks installed as required.

$$\frac{L}{3700} = \frac{(N)(D)(P)^{1/2}}{3700} = \text{allowable leakage in gallons per 2 hour test.}$$

L = 0.00331 ND; for 150 psi test for 2 hours.

N = Number of joints in the section tested.

D = Nominal pipe diameter in inches.

P = Average test pressure maintained during the leakage test psig (gauge).

2. During the two (2) hour period of the test, the Contractor shall maintain a continuous pressure of 200 psi, by means of a pump taking supply from a container suitable for the measurement of water loss. Should the test fail, the leak will be located and repaired and the test performed again until it meets the above specified limits.
3. Inspection of Work: All work is subject to inspection by the Water Purveyor, Owner and Engineer. The following phases of construction shall be inspected by the Owner and Engineer:
  - a. Placing of pipe, fittings and appurtenances. Hydrostatic Test.

### 3.6 ADJUSTING AND CLEANING

- A. Flushing: Flush underground mains and lead-in connections to sprinkler risers before connection is made to sprinklers, standpipes, or other fire protection system piping.
  1. Flush at flow rate not less than that indicated in NFPA 24, or at hydraulically calculated water demand rate of the system, whichever is greater.

END OF SECTION

## **SECTION 02720 - STORM SEWAGE SYSTEMS**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of Contract, apply to work of this Section.

#### **1.2 DESCRIPTION OF WORK**

- A. Extent of storm sewage systems work is indicated on drawings and schedules, and by requirements of this section.
- B. Refer to Division-2 section "EARTHWORK/UNDERGROUND UTILITIES" for excavation and backfill required for storm sewage systems; not work of this section.
- C. Refer to Division-3 sections for concrete work required for storm sewage systems; not work of this section.

#### **1.3 QUALITY ASSURANCE**

- A. **Manufacturer's Qualifications:** Firms regularly engaged in manufacture of storm sewage system's products of types, materials, and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.
- B. **Installer's Qualifications:** Firm with at least 3 years of successful installation experience on projects with storm sewage work similar to that required for project.
- C. **Codes and Standards:**
  - 1. **Plumbing Code Compliance:** Comply with applicable portions of Florida Department of Transportation Standard Specification, 1988 Edition, pertaining to selection and installation of storm sewage system's materials and products.
- D. **Environmental Compliance:** Comply with applicable portions of applicable Water Management District and Local Stormwater Management Codes pertaining to storm sewage systems.

#### **1.4 SUBMITTALS**

- A. **Product Data:** Submit manufacturer's technical product data and installation instructions for storm sewage system materials and products.
- B. **Shop Drawings:** Submit shop drawings for storm sewage systems, showing piping materials, size, locations, and inverts. Include details of underground structures,

connections, and manholes. Show interface and spatial relationship between piping and proximate structures.

- C. Record Drawings: At project closeout, submit record drawings of installed storm sewage piping and products, in accordance with requirements of Division-1.
- D. Maintenance Data: Submit maintenance data and parts lists for storm sewage system materials and products. Include this data, product data, shop drawings, and record drawings in maintenance manual; in accordance with requirements of Division-1.

## PART 2 - PRODUCTS

### 2.1 PIPES AND PIPE FITTINGS

- A. General: Provide pipes of one of the following materials, of weight/class indicated. Provide pipe fittings and accessories of same material and weight/class as pipes, with joining method as indicated.
1. Cast-Iron Soil Pipe: ASTM A 74, hub and spigot ends, service weight unless otherwise indicated.
    - a. Fittings: Cast-iron hub and spigot complying with ASTM A 74; lead/oakum caulked joints, or compression joints with rubber gaskets complying with ASTM C 564.
  2. Reinforced Concrete Pipe: FDOT 941, Class III (of ASTM C76).
    - a. Fittings: Reinforced concrete, same strength as adjoining pipe, tongue-and-groove gasketed joints complying with ASTM C 443.
    - b. Rubber Gaskets: FDOT 942.
  3. Polyvinyl Chloride (PVC) Sewer Pipe: ASTM D 3033, Type PSP, SDR 35; or ASTM D 3034, Type PSM, SDR 35.
    - a. Fittings: PVC, ASTM D 3033 or D 3034, elastomeric joints complying with ASTM D 3212 using elastomeric seals complying with ASTM F 477.
  4. Corrugated Steel Pipe and Pipe Arch: FDOT 943, bituminous coated both sides.
  5. Corrugated Steel Pipe and Pipe Arch: Aluminum coated (Aluminized Type II): AASHTO M274 and AASHTO M36.
  6. Coupling/Corrugated Steel Pipe and Pipe Arch: AASHTO M36 with rubber or neoprene gaskets, FDOT 430-8.1 (all pipe).
  7. Corrugated Aluminum Pipe and Pipe Arch: AASHTO M196 and AASHTO M211.
  8. Corrugated Aluminum Pipe with Perforations (360 degree): AASHTO M196 and M211, ASTM B 209 for Alloy Alclade 3004-H34.
  9. Coupling/Corrugated Aluminum Pipe and Pipe Arch: AASHTO M196 and AASHTO M211 with asphaltic mastic sealant (performed plastic material), (all pipe).
  10. Filter Fabric: Spun bound polypropylene, "TYPAR," as manufactured by DuPont, Style 3401.
  11. Bituminous Coating: AASHTO M190.
  12. Non-shrinking Mortar: Embeco 167 or approved equal.
  13. Precast Circular Manholes: Precast reinforced concrete per ASTM C 487, except wall thickness shall be 1 inch per foot of inside diameter plus 1 inch but 5 inch minimum.



- All openings shall have minimum steel hoop of #4 wire. Cement shall be Portland Type II. Provide a 6-inch lip on the base.
14. Concrete: FDOT 345-2 (except no pozzolon), 4, 6, 9, 10, 11, 12 and 13. Class II or Class III with minimum 28 day compressive strengths of 3400 psi and 5000 psi, respectively. Use Type II Portland Cement.
  15. Reinforcement: FDOT 415 (ASTM A615, Grade 60).
  16. Curing: FDOT 925.
  17. Brick: ASTM C 32, grade MC (hard brick).
  18. Mortar: For brick sections of manholes mix one (1) part Portland Cement Type II and three (3) parts of sand per FDOT 902-2.2. For mortar plaster use one (1) part cement, two (2) parts sand.
  19. Manhole Joint Sealer: Pre-formed plastic joint sealer per Federal Specification SS-S-00210 (GSA - PSS), "Ram-Nek" as manufactured by the K.T. Snyder Co., Inc., or approved equal, or Portland Cement mortar, 1/2 inch minimum thickness.
  20. Manhole Frame & Cover: Gray cast iron per ASTM A 48, Class 30 without perforations and suitable for addition of cast iron or steel rings for upward adjustment of top. The word "STORM" shall be cast into the face of the cover equal to that shown in the Standard Detail Drawings in 1-1/2 to 2 inch letters raised flush with the top of the cover. Frame and cover shall be approved equal to U.S. Foundry and Manufacturing Corp. No. 430 (old No. 32 with Type G cover). Frames and covers shall have machine ground seats and have a coating of coal tar pitch varnish.  
Where prefabricated adjustable frames are called for in the Drawings, they shall be approved equal to U.S. Foundry No 560 (old No. 23 with Type G Cover) and comply with the above requirements.
  21. Inlet Gratings and Frames: Structural steel, FDOT 425-3.2, U.S. Foundry or equal; Gray Cast Iron, FDOT 962-8.
  22. Bitumastic: Koppers No. 300M, or approved equal.
  23. Non-shrink Mortar: Embeco 167 or approved equal.
  24. Forms: Forms shall be either wood or metal, externally secured and braced when feasible, substantial and unyielding, and of adequate strength to contain the concrete and the additional force of vibration consolidation without bulging between supports and without apparent deviation from neat lines, contours and shapes shown in the Drawings.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION OF PIPE AND PIPE FITTINGS

- A. General: Trench excavation and backfill, including sheeting and bracing dewatering, foundation and bedding and furnishing and disposal of materials shall be as specified in Section 02210 of these Standard Specifications, "EARTHWORK- UNDERGROUND UTILITIES" with any additional requirements included herein.
- B. Laying Pipe: Pipe shall be laid "in the dry" true to the lines and grades given with hubs upgrade and tongue fully inserted into the hub. Provide recesses at each joint as

required to establish continuous loading conditions along the pipe barrel. Maintain a clean interior as the work progresses. Adequate filtering methods shall be provided to prevent flushing debris and sediment into any receiving waters.

- C. Round Concrete Pipe: ASTM C443-85a. Seal all joints with round rubber gaskets. The gasket and the surface of the joints must be clean and free of grit, dirt and other foreign matter. To facilitate closure of the joint, apply a vegetable soap lubricant immediately prior to closing. Do not apply mortar, joint compound, or other filler which will restrict the flexibility of the gasket joint.

Deviations from true alignment or grade, which result in a displacement from the normal position of the gasket of as much as 1/4 inch, or which 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 occur the pipe shall be re-laid without additional compensation. Where minor imperfections cause 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.

- D. Oval Concrete Pipe: Seal all joints with round rubber gaskets. The gasket and the surface of the joints must be clean and free of grit, dirt and other foreign matter. To facilitate closure of the joint, apply a vegetable soap lubricant immediately prior to closing. Do not apply mortar, joint compound, or other filler which will restrict the flexibility of the gasket joint.
- E. Corrugated Steel Pipe: Field joint corrugated steel pipe with locking steel bituminous coated bands and rubber or neoprene gaskets to secure a water-tight joint. The gaskets shall be at least 7 inches in width and at least 3/8 inches thick, or O-ring gaskets with a minimum chord diameter of 13/16 inch, with annular ends. A vegetable soap lubricant is acceptable to facilitate the field connection. A minimum of 10-1/2 inch bandwidth shall be provided.
- F. Corrugated Aluminum Pipe: Make field joints with aluminum bands and asphaltic mastic gasket to secure a watertight joint. Band width shall be a minimum of 7 inches for 6 - 30 inch diameter and 12 inches for 36 - 60 inch diameter pipes.
- G. Cast-Iron Soil Pipe: Install in accordance with applicable provisions of CISPI "Cast Iron Soil Pipe & Fittings Handbook."
- H. Plastic Pipe: Install in accordance with manufacturer's installation recommendations, and in accordance with ASTM D 2321.
- I. Cleaning Piping: Clear interior of piping of dirt and other superfluous material as work progresses. Maintain swab or drag in line and pull past each joint as it is completed.
1. In large, accessible piping, brushes and brooms may be used for cleaning.

2. Place plugs in ends of uncompleted conduit at end of day or whenever work stops.
  3. Flush lines between manholes if required to remove collected debris.
- J. Joint Adapters: Make joints between different types of pipe with standard manufactured adapters and fittings intended for that purpose.
- K. Closing Abandoned Utilities: Close open ends of abandoned underground utilities which are indicated to remain in place. Provide sufficiently strong closures to withstand hydro-static or earth pressure which may result after ends of abandoned utilities have been closed.
1. Close open ends of concrete or masonry utilities with not less than 8 inches thick brick masonry bulkheads.
- L. Interior Inspection: Inspect piping to determine whether line displacement or other damage has occurred.
1. Make inspections after lines between manholes, or manhole locations, have been installed and approximately 2 feet of backfill is in place, and again at completion of project.
  2. If inspection indicates poor alignment, debris, displaced pipe, infiltration or other defects, correct such defects, and reinspect.

### 3.2 STORM SEWER STRUCTURES

- A. Fabrication: All structures shall be constructed as shown in the Drawings or Standard Detail Indexes per FDOT Roadway and Bridge Design Standards. Structures may be precast concrete or poured in place concrete.
- B. Foundation: Compact the soil beneath the structure to 95 percent of maximum (AASHTO T-180) density. Additionally provide 9 inches of gravel beneath structures with precast bases.
- C. Manhole Base: Construct per Standard Detail Drawings with Type II Portland Cement concrete, Class II or cast as an integral part of the precast section. If the base is poured, form a groove in the base with an accurate manhole ring, shape with a wood float and finish with a hard steel trowel prior to setting. The base shall set a minimum of 24 hours before the manhole construction proceeds. Precast base shall have a minimum of three lifting hooks set in. The base shall extend 6 inches on all sides of the structure.
- D. Joints - Precast Structures: Structures without precast integral bottoms shall be set in a bed of mortar to make a watertight joint at the base. Join precast sections with a minimum mortar thickness of 1/2 inch, maximum of 1 inch. Joint sealer may be used as an alternate.
- E. Poured-in-place Concrete Structures: Concrete shall not be placed in any form until

the reinforcing steel has been inspected and approved. Place concrete as noted in the Drawings and vibrate thoroughly. Fill each part of the forms, work the course aggregate back from the face and force the concrete under and around the reinforcing bars without displacing them from proper position. Place the concrete in approximately 12 inch lifts so as not to induce separation or segregation of the aggregates, consolidate thoroughly before proceeding onward continuously so that there will be no plain separation between layers. Provide construction joints in accordance with the Drawings. Rub all exposed surfaces smooth to a point 12 inches below the proposed finished grade. All slabs open to traffic will be broom finished.

- F. Curing: Cure continuously for a period of at least 72 hours, to commence after the finishing has been completed and as soon as the concrete has hardened sufficiently to permit application of the curing material without marring the surface. Curing may be accomplished by means of polyethylene covering, membrane curing compound, or wet-burlap. These methods shall initiate after the forms are removed and as outlined below:
1. Burlap. Place burlap over the entire surface of the concrete with overlap of approximately 6 inches along each edge and in contact with the entire surface.
  2. Membrane Curing Compound. Apply membrane compound (clear or white) in one continuous uniform coating at a rate of one gallon per 200 square feet of area. Immediately recoat any crack or other defects appearing in the coating. Agitate the compound prior to application as well as during to prevent settlement of the pigment.
  3. Polyethylene Sheeting. Place polyethylene sheeting over the entire surface with sufficient overlap of approximately 6 inches along the sides. Sheeting should be in continuous contact with the concrete at all times.
- G. Manhole Invert: shape invert channels to a trowel finish conforming to the sizes and shapes of the lower 0.8 diameter of the inlets and outlets called for in the Drawings. changes in direction of the sewer and entering branch or branches shall have a true curve, with a centerline radius of at least three times the pipe diameter or channel width. Straight-through channels may be formed with pre-cut half pipes.
- H. Manhole Coating: Coat the exterior surface with one coat of bitumastic at a minimum rate of 375 square feet per gallon, factory applied and "touched-up" in the field.
- I. Manhole Frames and Covers: Set manhole frames and covers to conform to the grades in the Drawings. Set all frames securely in a cement mortar bed and fillet. All covers shall be made flush with existing permanent surfaces except outside the limits of the traveled ways where they should be set approximately 0.2 foot above the existing ground unless otherwise noted in the Drawings.
- J. Manholes Watertightness: When tested by plugging all inlets and the outlet and filling the structure to within one foot of the cone section or top, with a minimum depth of 4 feet and maximum depth of 20 feet, the maximum allowable drop of the water surface shall be 1/2 inch per 15 minute interval. Contractor shall plug all leaks by method

approved by the Engineer.

- K. Pipe Connections: Seal pipes into structure openings with non-shrinking mortar. Provide one joint immediately outside the structure wall. Openings into existing structures shall be cut with a power driven abrasive wheel or saw.

### 3.3 BACKFILLING

- A. General: Conduct backfill operations of open cut trenches closely following laying, jointing, and bedding of pipe, and after initial inspection and testing are completed.

### 3.4 FIELD QUALITY CONTROL

- A. Lamping: Lamp all sewers between manholes, and catch basins after the backfill has been compacted to determine that they are clear of debris and to the correct alignment. The concentricity of the lamp image received shall not vary in the vertical direction but may vary up to 20 percent in the horizontal direction.
- B. Inspection: Final visual inspection shall be made after all structures are raised to finished grade and the roadway installed. If the lines are unclean, clean-up and re-lamping shall be initiated. Contractor shall assist the engineer during this inspection.

END OF SECTION

## **SECTION 02730 - SANITARY SEWAGE SYSTEMS**

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract apply to work of this Section.

#### 1.2 DESCRIPTION OF WORK

- A. Extent of Sanitary sewage systems work is indicated on drawings and schedules, and by requirements of this section.
- B. Refer to Division-2 section "Earthwork - Underground Utilities" for excavation and backfill required for sanitary sewage systems; not work of this section.
- C. Refer to Division-3 sections for concrete work required for sanitary sewage systems; not work of this section.
- D. Refer to Division-15 section "SOIL AND WASTE SYSTEMS" for interior building systems including drain, waste, and vent piping; not work of this section.

#### 1.3 QUALITY ASSURANCE

- A. **Manufacturer's Qualifications:** Firms regularly engaged in manufacture of sanitary sewage system's products of types, materials, and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.
- B. **Installer's Qualifications:** Firm with at least 3 years of successful installation experience on projects with sanitary sewage work similar to that required for project.
- C. **Codes and Standards:**
  - 1. **Plumbing Code Compliance:** Comply with applicable portions of National Standard Plumbing Code pertaining to selection and installation of sanitary sewage system materials and products.

#### 1.4 SUBMITTALS

- A. **Product Data:** Submit manufacturer's technical product data and installation instructions for sewage system materials and products.
- B. **Shop Drawings:** Submit shop drawings for sanitary sewage systems, showing piping materials, size, locations, and inverts. Include details of underground structures,

connections, and cleanouts. Show interface and spatial relationship between piping and proximate structures.

- C. Record Drawings: At project closeout, submit record drawings of installed sanitary sewage piping and products, in accordance with requirements of Division-1.
- D. Maintenance Data: Submit maintenance data and parts lists for sewage system materials and products. Include this data, product data, shop drawings, and record drawings in maintenance manual; in accordance with requirements of Division-1.

## PART 2 - PRODUCTS

### 2.1 IDENTIFICATION

- A. Underground-Type Plastic Line Markers: Manufacturer's standard permanent, bright-colored, continuous-printed plastic tape, intended for direct-burial service; not less than 6 inches wide x 4 mils thick. Provide green tape with black printing reading "CAUTION SEWER LINE BURIED BELOW."
  - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering identification markers which may be incorporated in the work include, but are not limited to, the following:
    - a. Allen Systems, Inc.
    - b. Emed Co., Inc.
    - c. Seton Name Plate Corp.

### 2.2 PIPES AND PIPE FITTINGS

- A. Polyvinyl Chloride Pipe & Fittings (PVC): Pipe and fittings, ASTM D3034, SDR 35 and shall have integrally formed bell and spigot with factory installed rubber sealing ring gaskets. Pipe shall be in maximum laying length of 12.5 feet. Joints, ASTM D3212, push-on type elastomeric compression gaskets. Field solvent weld joints are not acceptable. PVC materials shall be approved equal to "Ring-Tite" as manufactured by Johns-Manville.
- B. Ductile Iron Pipe & Fitting (DI): Pipe shall be ductile iron (DI) with minimum thickness of Class 51 for 3 and 4 inch and Class 50 for larger pipe. ANSI 21.51 (AWWA C151); Fittings, ANSI 21.10 (AWWA C110); Joints, ANSI 21.11 (AWWA C111).
- C. Gray Iron Pipe & Fittings (GI): Pipe, ANSI 21.6 (AWWA C106); Fittings, ANSI 21.10 (AWWA C110); Joints, ANSI 21.11 (AWWA C111).
- D. Pipe Coupling & Bushing Adapter: Rubber couplings with stainless steel ring clamps at

both ends and stainless steel shear ring and rubber bushings as required, approved equal to Mission Rubber Company, Inc.

- E. PVC - Manhole Connector: Asbestos-cement manhole adapter, approved equal to Johns-Manville.
- F. Non-shrink Mortar: Embeco 167 or approved equal.
- G. Precast Manholes: Precast reinforced concrete per ASTM C478, except wall thickness shall be 1 inch per foot of inside diameter plus 1 inch but 5 inch minimum. All openings shall have minimum steel hoop of #4 wire. Cement shall be Portland Type II. Manholes shall be in accordance with the Standard Detail Drawings.
- H. Concrete: FDOT 345-2 (except no pozzolan), 4, 6, 9, 10, 11, 12 and 13. Class I, Class II, and Class III shall have minimum 28 day compressive strengths of 2500 psi, 4000 psi, and 5000 psi, respectively.
- I. Reinforcement: FDOT 415
- J. Curing: FDOT 925
- K. Brick: ASTM C32, grade MC (hard brick).
- L. Mortar: For brick sections of manholes mix one (1) part Portland Cement Type II and three (3) parts of sand per FDOT 902-2.2. For Mortar plaster use one (1) part cement, two (2) parts sand.
- M. Manhole Joint Sealer: Pre-formed plastic joint sealer per Federal Specification SS-S-00210 (GSA-PSS), "Ram-Nek" as manufactured by the K.T. Snyder Col, Inc., or approved equal.
- N. Manhole Frame & Cover: Gray cast iron per ASTM A48, Class 30 without perforations and suitable for addition of cast iron or steel rings for upward adjustment of top. The word "SANITARY" shall be cast into the face of the cover equal to that shown in the Standard Detail drawings in 1 1/2 to 2 inch letters raised flush with the top of the cover. Frame and cover shall be approved equal to U.S. Foundry and Manufacturing Corp. No. 430 (old No. 32 with Type G cover). Frames and covers shall have machine ground seats and have a coating of coal tar pitch varnish.

Where prefabricated adjustable frames are called for the Drawings, they shall be approved equal to U.S. Foundry No. 560 (old No. 23 with Type G cover) and comply with the above requirements.

Where manholes are subjected to periodic flooding or lie within the 100 year flood plain, or as designated by the Engineer, frames and covers shall be made watertight by



means of gaskets and bolted covers approved equal to U.S. Foundry.

- O. Bitumastic: Koppers No. 300M, or approved equal.
- P. Bedding Material: Bedding materials shall be as specified in Section 02210 of these Standard Specifications, "Earthwork - Underground Utilities".

### PART 3 - EXECUTION

#### 3.1 INSTALLATION OF IDENTIFICATION

A. General: During back-filling/top-soiling of sanitary sewage systems, install continuous underground-type plastic line marker, located directly over buried line at 24 inches below finished grade.

#### 3.2 INSTALLATION OF PIPE AND FITTINGS

- A. Pipe Laying & Jointing: Lay pipe with spigot ends pointing in the direction of flow starting at the lowest point. Clean joint contact surfaces immediately prior to jointing. Use lubricants, primers and adhesives as recommended by the joint manufacturer.
- B. Branches: Wye branches are to be installed in conjunction with the laying of the sewer pipe. Install wyes to serve all existing and future dwelling units, as noted in the Drawings. The longitudinal barrel of branch fittings shall conform to the line and grade, diameter, and quality of the sewer main. All service laterals shall be perpendicular to the longitudinal axis of the pipe.
- C. Laterals: Install service laterals and wye branch fittings as shown in the Standard Detail Drawings and as sized and located in the Drawings. Laterals shall be located between 3 feet minimum and 5 feet maximum below right-of-way finished grade at the service. Laterals shall be run perpendicular to the sewer main at a minimum grade of 1 percent from the main to the right-of-way line. Provide a wye branch fitting for each service lateral; double wyes are not acceptable. Plug all laterals and service wyes at the last joint and securely seal to withstand the internal pressure of leakage or air pressure testing, but the plug shall also be capable of removal without injury to the socket. Chisel an "S" in the top of the curb directly over the lateral location. If curbing is not part of the work, install a 4" x 4" X 3'0" wooden stake at the end of the connection.
- D. Transition Connections: Where pipes of different materials are to be connected between manholes, suitable transition couplings shall be installed. Couplings as cited herein are the only acceptable materials.

- E. Connections to Existing Lines: Use a collar wye saddle for 4 inch and 6 inch diameter connections into existing sewer lines. The existing line shall be cut using a template to accomplish a true and clean opening for the saddle. Gasketed saddles with stainless steel straps shall be used where available from the manufacturer. The sewer main shall be protected and cleaned of debris.
- F. Chimney Connections: Provide chimney connections, as shown in the Standard Detail Drawings where the depth of sewer main invert exceeds 10 feet below the finished grade of the street, unless otherwise required by the Engineer. One chimney may only serve 4 connections -double to each side or less. Chimney shall be encased in Class I Concrete.
- G. Connections to Manholes: Connections shall be in accordance with the Standard Detail Drawings. PVC connections shall be made using an asbestos-cement adapter pre-cast or mortared into the structure. Clay pipe and iron pipe (and asbestos-cement adapters when mortared) shall be mortared into structures with non-shrinking mortar applied and cured in strict conformance with manufacturer's recommendations such that no leakage through the annular joint occurs. Finish mortar smooth and flush with the adjoining interior and exterior wall surfaces. Clay pipe shall have a short nipple (18 inch or 24 inch) between the manhole fitting and the first full length of pipe. All openings for pipes into existing structures shall be made by cutting with a power driven abrasive wheel or saw.
- H. Connections to Wet wells: Provide one (1) joint (18 - 20 feet) of ductile iron pipe to extend outward from the structure. Mortar the connections as per above.
- I. Conflicting Structures: Where it becomes necessary to extend sewers through structures, such as conflicting manholes, junction boxes, etc., the pipe within shall be ductile iron with no joints inside the conflicting structure.
- J. Manholes: Manholes shall be in accordance with the Standard Detail Drawings. Manholes shall be precast with integral slab and lower ring, or poured in place slab with precast ring wall or mortared brick wall construction. All manholes shall have bitumastic coating as specified herein.
- Brick manholes shall be true and symmetric with all courses level. Bricks shall be placed by shoving into a full bed of mortar with 1/4 to 1/2 inch joints completely filled. Courses shall be laid continuously with alternating joints and with whole headers every sixth course. Excess mortar shall be carefully struck off. Portland cement plaster (1/2 inch minimum) shall be applied to the interior and exterior brick surfaces. Brick manholes shall be protected and kept moist for at least 48 hours following completion during hot or dry weather.
- K. Manhole Foundation: Compact the soil beneath the manhole to 95% of maximum (AASHTO T-180) density. Additionally provide 9 inches of gravel beneath precast

manhole bases.

- L. Manhole Base: Poured in place with Type II Portland cement concrete per Standard Detail Drawings or cast as an integral part of the precast section. If the base is poured, from a groove in the base with an accurate manhole ring, shape with a wood float and finish with a hard steel trowel prior to setting. The base shall set a minimum of 24 hours before the manhole construction proceeds. Precast base shall have a minimum of three lifting hooks set in and shall have a 6-inch lip.
- M. Manhole Invert: Shape invert channels to a trowel finish conforming to the sizes and shapes of the lower 0.8 diameter of the inlets and outlets called for in the Drawings. Changes in direction of the sewer and entering branch or branches shall have a true curve, with a centerline radius of at least three times the pipe diameter or channel width. Straight-through channels may be formed with pre-cut half pipes.
- N. Manhole Coating: Two (2) coats of bitumastic applied to the internal surfaces at a minimum rate of 120 square feet per gallon per coat and one coat to external surfaces at a minimum rate of 375 square feet per gallon. External surfaces shall be pre-painted. Internal surfaces shall be painted in the field after installation and after inspection.
- O. Top Elevation: Adjust precast manhole top between 6 inches and 12 inches by means of precast concrete rings or bricks laid in mortar.
- P. Manhole Frames and Covers: Set manhole frames and covers to conform to the grades in the Drawings. Set all frames securely in a cement mortar bed and fillet. All covers shall be made flush with existing permanent surfaces except outside the limits of the traveled ways where they should be set approximately 0.2 foot above the existing ground unless otherwise noted in the Drawings.
- Q. Stubs and Stoppers: Install pipe stoppers to all manhole stubs noted in the Drawings. When connecting to an existing stub, prior to removing the existing stopper, brick the inside opening to prevent any flow until the new system has been tested and cleaned. The brick shall not be removed until final inspection.
- R. Bulkheading Stub Channels: Bulkhead the downstream end of all outlets in the manholes of stub-out-channels not in use, to prevent the creation of a septic condition resulting from ponding of sewage or debris up the used channel.
- S. Protection of Water System at Crossings: Where the location of the sewer is not clearly defined by dimensions on the drawings, the sewer shall not be laid closer horizontally than 10 feet to a water main or service line. Pressure sewer lines shall only pass beneath water lines, with the top of the sewer line being at least 2 feet below bottom of water line. Where sanitary sewer lines pass above water lines, the sewer shall be encased in concrete for a distance of 10 feet on each side of the crossing, or rubber-

gasketed pressure pipe shall be substituted for the pipe being used for the same distance. Where sanitary sewer lines pass below water lines, no joint in the sewer line shall be closer than 3 feet, horizontal distance, to the water line. Each pipe shall be carefully inspected before and after it is installed and defective pipe shall be rejected. Proper facilities shall be provided for lowering sections of pipe into trenches.

- T. Downstream Protection: Pipe shall not be flushed downstream. Open end of pipe shall be closed daily to prevent foreign matter from entering.
- U. PVC Ring Deflection: Maximum diametric ring deflection shall not exceed 5 percent of the internal pipe diameter throughout the warranty period when tested by a mandrel.

### 3.3 FIELD QUALITY CONTROL

- A. Testing - Low Pressure Air Leakage: All sanitary sewers shall be tested by means of a low pressure air leakage test. When tested by this method, the pipe is first pressure stabilized at 4 psig greater than the average groundwater back-pressure: Subsequent leakage shall not exceed the following:

0.0015 cubic feet per minute per square foot for PVC.  
0.0030 cubic feet per minute per square foot for VCP.

- B. Testing - Infiltration or Exfiltration: If approved by Engineer, infiltration or exfiltration test may be performed in lieu of the air pressure test. When tested a minimum of three (3) days after the cessation of dewatering, the maximum allowable leakage shall not exceed the following rates per mile of main line (not laterals):

50 gallons per day per nominal inch for PVC  
100 gallons per day per nominal inch for VCP

- C. Testing - Manhole Watertightness: Contractor shall test manhole watertightness by plugging all inlets and the outlet and filling the manhole to within one foot of the cone section. With a minimum depth of 4 feet and maximum depth of 20 feet, the maximum allowable drop of the water surface shall be 1/2 inch per 15 minute interval. Contractor shall plug all leaks by method approved by Engineer.
- D. Lamping: Contractor shall lamp between manholes. The concentricity at the lamp image received shall be such that the diameter of said image shall have no vertical reduction from that of the pipe inside diameter and not more than 20 percent horizontal reduction.
- E. Resurfacing: All test shall be completed and accepted by Engineer before any trench or pavement is surfaced/resurfaced.
- F. Final Inspection: After all manholes are raised to grade and paving operations

completed, a final visual inspection will be made. Contractor shall assist the engineer by providing labor as required. Additional lamping may be required if it appears that lines are unclean. Contractor will be present to note required corrections, if any, and schedule their remedial action immediately before the work is accepted.

END OF SECTION 02730

## **SECTION 02800 - LANDSCAPING**

### PART I – GENERAL

#### 1.1 DESCRIPTION OF WORK:

- A. The extent of the landscape development work is shown on the drawings and in schedules. Completion of the work shall mean full and exact compliance and conformity with the Contract Documents.
- B. The work under this section includes supplying, installing and planting of trees, shrubs and ground covers in accordance with sound nursery practice and maintaining and watering them until Final Acceptance of the project by Owner.

#### 1.2 QUALITY ASSURANCE:

- A. Qualifications of Installers: The Contractor shall have labor crews controlled and directed by a landscape foreman well versed in plant materials, planting, reading blueprints and coordination between project and nursery, in order to execute installation correctly.
- B. Trees and Shrubs: Provide trees and shrubs grown in a recognized nursery in accordance with good horticultural practice. Provide healthy vigorous stock grown under climatic conditions similar to conditions in the locality of the project and free of disease, insects, eggs, larvae, and defects such as knots, sun-scald, injuries, abrasions, or disfigurements. All plant material shall be graded Florida No. 1 or better as outlined under Grades and Standards for Nursery Plants, State Plant Board of Florida.

#### 1.3 PROTECTION:

- A. The Contractor shall protect all materials and work against injury from any and all causes, and shall provide and maintain all necessary safeguards for the protection of the public.
- B. Trees moved by winch or crane shall be thoroughly protected from chain marks, girdling, or other bark slippage by means of burlap, wood battens or other approved method.
- C. Container grown plants shall be carefully removed from the container so as not to disturb the root system. A spade shall not be used to cut containers.

#### 1.4 EXISTING PROJECT CONDITIONS:

- A. The Contractor shall exercise care in digging and in the performance of other work so as not to damage existing work including underground pipes and cables. Should such overhead or underground obstructions be encountered which interfere with planting, the location of plants shall be adjusted to clear

such obstruction.

- B. The Contractor shall be responsible for the immediate repair of any damage caused by his work.
- C. Should any objectionable materials such as concrete, bricks or other debris be encountered during planting operations, the Contractor shall remove them from the site.

1.5 COORDINATION:

- A. The Contractor shall be responsible for coordinating his work with all other parties involved with the project in order to eliminate unnecessary complication during the installation of landscape work.

1.6 GUARANTEES:

- A. All plant materials, except sod, shall be guaranteed for one year from the date of Final Acceptance by Owner and shall be alive and in satisfactory growth for each specific kind of plant at the end of the guarantee period.
- B. Sod shall be guaranteed for a period of 60 days from the date of Final Acceptance by Owner.
- C. During the guarantee period, any plant required by the Contract Documents that is dead or not in satisfactory growth, as determined by the Architect, shall be removed and replaced. Replacement plants shall have a guarantee as specified above. All replacements shall be made within ten days of notice to the Landscape Contractor.
- D. Specifically excluded from the guarantee are damages resulting from natural causes such as floods, lightning strikes, freezing rains, damages from acts of negligence on the part of the Owner or others occupying the site, fires, vandalism and herbivorous animals.

1.7 SUBMITTALS:

- A. Submit soil test results as specified in Part 2.3.E. and Part 3.1.A. of this Section.
- B. Submit maintenance instructions as outlined in Part 3.7. of this Section.

PART II – PRODUCTS

2.1 NOMENCLATURE:

- A. Conform to the names given in Standardized Plant Names, 1942 Edition, prepared by the American Joint Committee on Horticultural Nomenclature. Names of varieties not included therein conform generally to names accepted in the nursery trade.

2.2 MEASUREMENTS:

- A. Plants shall be measured when branches are in their normal position. Height and spread dimensions refer to main body of plant and not branch tip to tip.
- B. The measurements specified are the minimum size acceptable and are the measurements after pruning, where pruning is required.

2.3 TOPSOIL:

- A. Topsoil shall be a friable loam, typical of cultivated topsoil locally, containing at least 5 percent of decayed organic matter (humus).
- B. Material shall be taken from a well-drained, arable site. It shall be reasonably free of weeds, subsoil, stones, earth, clods, sticks, roots or other objectionable extraneous matter or debris.
- C. Topsoil shall not contain toxic materials and shall have an acidity range of pH 6.0 to 7.0.
- D. Topsoil from nut grass infested areas will not be acceptable.
- E. Prior to being delivered at the planting site, the topsoil shall have been approved by the Architect. Representative samples shall be tested for acidity, fertility and general texture by a recognized commercial or governmental agency. Locations and numbers of tests shall be determined by the Architect. Copies of the testing agency's findings and recommendations shall be furnished to the Architect prior to commencement of planting operations. Following treatment of topsoil as recommended by the testing agency, topsoil shall be re-tested to confirm that adequate amendments have been provided. Results of re-testing shall be furnished to Architect prior to the start planting operations.

2.4 FERTILIZER:

- A. Fertilizer shall be Agriform 21 GRAM Tablets, slow release, 20-10-5 analysis, or an approved equal. Rates of application shall be as follows:

1-gal. can plants	1 tablet each
3-gal. can plants	2 tablets each
5-gal. can plants	3 tablets each
Trees	1 tablet per each 1/2" of trunk diameter: For multiple trunks, the diameter measurements will be cumulative.

- B. Starter fertilizer shall be 6-6-6, 100% organic, with minor elements. This fertilizer shall have a 40% - 50% of its total nitrogen in a water-insoluble form.



- C. Lawn areas shall be treated with Agriform 34-0-7 Turfmix or approved equal Fertilizer applied at a rate of 16 pounds per 1000 square feet.
- D. Soil used for planting (Planting Mix) shall consist of 2 parts of existing soil and 1 part domestic peat moss, mixed with 2 lbs. of starter fertilizer per cubic yard.
- E. Osmocote 18-6-12 slow-release or approved equal fertilizer at the rate of 16 pounds per 1000 square feet.

2.5 MISCELLANEOUS LANDSCAPE MATERIALS:

- A. Anti-Desiccant: Emulsion type, film-forming agent designed to permit transpiration but retard excessive loss of moisture from plants. Deliver in manufacturer's fully identified containers and mix in accordance with manufacturer's instructions.
- B. Wrapping: Tree-wrap tape not less than 4" wide, designed to prevent borer damage and winter freezing.
- C. Stakes and Guys: Provide stakes and deadmen of sound new hardwood, treated softwood, or redwood, free of knotholes and other defects. Provide wire tires and guys of 2-strand, twisted, pliable galvanized iron wire not lighter than 12 Ga. with zinc-coated turnbuckles. Provide not less than 1/2" diameter rubber or plastic hose, cut to required lengths and of uniform color, material and size to protect tree trunks from damage by wires.

PART III - EXECUTION

3.1 PREPARATION:

- A. The Contractor shall test each site area for soil pH. Provide and supply such soil amendments as are necessary to adjust the pH range of each area to a level that will provide optimum conditions for the vigorous growth of the specified new plant material and grass (6.0 - 6.5). Submit test results and proposed soil amendments outline to the Architect prior to amending soils and prior to starting planting operations.

3.2 PLANT PITS:

- A. Circular pits with vertical sides shall be excavated for all plants. Diameter of pits for trees shall be at least 2' greater than the diameter of the root ball. Diameter of pits for shrubs shall be at least 1' greater than the root ball.

3.3 INSTALLATION/APPLICATION/PERFORMANCE:

- A. All plants except as otherwise specified, shall be centered in pits and set on compacted top soil to such a depth that the finished grade level at the plant after settlement will be the same as that at which the plant was grown. No

burlap shall be pulled out from under root balls or be left exposed to view.

- B. Roots shall be spread in their normal position. All broken or frayed roots shall be cut off cleanly. Soil shall be placed and compacted thoroughly, avoiding injury and shall be settled by watering. No filling around trunks will be permitted.
- C. Layout individual tree and shrub locations and areas for multiple planting. Stake locations and outline areas and secure Architect's acceptance before start of planting work. Make minor adjustments as may be requested.
- D. Form temporary earth saucers with 6" high berm around all newly planted trees. Saucer diameter for trees 4" caliper or less shall be approximately 3'. Saucer diameter for trees greater than 4" caliper shall be approximately 6'. All trees shall be watered daily for the first month. Remove saucer berm as final mulching and sodding takes place.
- E. New planting shall be so set that the final level of ground around the plants shall conform to surrounding grades, or as otherwise specified.
- F. All plant beds, unless otherwise noted, including tree saucers, shall be top-dressed with 2" - 3" mini pine bark nuggets. All planters and mulched areas adjacent to pavement shall have mulch installed so that top of mulch is 1" below the final grade of the planter or adjacent paving.
- G. The amount of pruning on new plant material shall be limited to the minimum necessary to remove dead or injured branches to compensate for the loss of roots as a result of transplanting operations. Pruning shall be done in such a manner as not to change the natural habit or shape of a plant. All cuts over 1/2" diameter shall be treated with an approved antiseptic tree wound dressing.

#### 3.4 MAINTENANCE:

- A. The Contractor shall maintain all plant materials in a first class condition from the beginning of landscape construction until Final Acceptance by Owner, including proper watering.
- B. Maintenance shall include, but not be limited to, watering of turf and planting beds, mowing, cultivation, weeding, pruning, disease and pest control, replacement of dead or unacceptable materials, straightening turf or planter settlement areas, guy wire repair and tightening, repair of wash-outs, and any other procedure consistent with good horticultural practices necessary to insure normal, vigorous and healthy growth of all work under this contract.

#### 3.5 GRADES:

- A. It shall be the responsibility of the Contractor to finish (fine) grade all landscape areas, eliminating all surface irregularities, depressions, sticks, stones, and other debris.

3.6 CLEANING:

- A. The Contractor shall at all times keep the premises (grounds and pavements) free from accumulations of waste materials or rubbish caused by his employees or work.

3.7 MAINTENANCE INSTRUCTIONS:

- A. Submit typewritten instructions recommending procedures to be established by Owner for maintenance of landscape work for one full year.
- B. Submit prior to expiration of required maintenance period.

END OF SECTION 02800

## **SECTION 02820 - GRASSING**

### PART I – GENERAL

#### 1.1 SCOPE:

- A. This section includes the furnishing and installation of grassing materials at areas indicated on the drawings.
- B. Excavation, filling and grading specified in SECTION 02200 - EARTHWORK.
- C. Grassing shall be performed by a knowledgeable nurseryman or landscaping specialist knowledgeable with climate conditions and planting requirements of the geographical area.

### PART II – PRODUCTS

#### 2.1 TOPSOIL:

- A. Topsoil is specified in SECTION 02800 - LANDSCAPING
- B. Topsoil shall be stockpiled for re-use in grass work. If quantity of stockpiled topsoil is insufficient, provide additional topsoil as required to complete grassing.

#### 2.2 FERTILIZER:

- A. Lawn fertilization is specified in SECTION 02800 - LANDSCAPING

#### 2.3 GRASS MATERIALS:

##### A. SOD:

- 1. Shall be strongly rooted sod, not less than two years old, free of weeds and undesirable native grasses and machine cut to pad thickness of 2" ( $\pm 1/4$ "), excluding top growth and thatch. Provide only sod capable of vigorous growth and development when planted (viable not dormant).
- 2. Sod shall be furnished in uniform pad sizes with maximum 5% deviation in length or width. Broken pads or uneven ends will not be acceptable. Sod pads incapable of supporting their own weight when suspended vertically with a firm grasp on upper 10% of pad will be rejected.

3. Sod shall be Argentine Bahia unless noted on plans to be St. Augustine 'Floritam' grass or Bahia seed and mulch.
4. Grass Seed Mix: Shall be Argentine Bahia, with a minimum purity of 85%, minimum germination of 80% and weed content not to exceed one-half percent (1/2%). A cover grass shall be mixed with the Bahia seed as follows:
  - a) March - October: 2/3 Bahia and 1/3 Brown Top Millet.
  - b) November - February: 2/3 Bahia and 1/3 Winter Rye.

### PART III – EXECUTION

#### 3.1 GENERAL:

- A. Utilities: Determine location of underground utilities and perform work in a manner which will avoid possible damage. Hand excavate, as required.
- B. Correlate planting with specified maintenance periods to provide maintenance to the date of Final Acceptance by Owner.

#### 3.2 PREPARATION:

- A. Preparation for Planting Portions of Lawns:
  1. Loosen subgrade of lawn areas to a minimum depth of 4". Remove stones over 1-1/2" in any dimension and sticks, roots, rubbish and other extraneous matter. Limit preparation to areas which will be planted promptly after preparation.
  2. Spread topsoil to minimum depth required to meet lines, grades and specified elevations, after light rolling and natural settlement. Add specified soil amendments and mix thoroughly into upper 4" of topsoil.
  3. Place approximately 1/2 of total amount of topsoil required. Work into top of loosened subgrade to create a transition layer and then place remainder of planting soil. Add specified soil amendments and mix thoroughly into upper 4" of topsoil.
  4. Preparation of Unchanged Grades: Where lawns are to be planted in areas that have not been altered or disturbed by excavating, grading, or stripping operations, prepare soil for lawn planting as follows: Till to a depth of not

less than 6"; apply soil amendments and initial fertilizers as specified; remove high areas and fill in depressions; till soil to a homogenous mixture of fine texture, free of lumps, clods, stones, roots and other extraneous matter.

5. Prior to preparation of unchanged areas, remove existing grass, vegetation and turf as indicated on grading drawings. Dispose of such material outside of Owner's property; do not turn over into soil being prepared for lawns.
6. Apply specified commercial fertilizer at rates specified and thoroughly mix into upper 2" of topsoil. Delay application of fertilizer if lawn planting will not follow within a few days.
7. Fine grade lawn areas to smooth, even surface with loose, uniformly fine texture. Roll, rake and drag lawn areas, remove ridges and fill depressions, as required to meet finish grades. Limit fine grading to areas which can be planted immediately after grading.
8. Moisten prepared lawn areas before planting if soil is dry. Water thoroughly and allow surface moisture to dry before planting lawns. Do not create a muddy soil condition.

### 3.3 SODDING NEW AREAS OF LAWNS:

- A. Lay sod within 24 hours from time of stripping. Do not plant dormant sod or if ground is frozen.
- B. Allow for sod thickness in areas to be sodded. It shall be the responsibility of the Contractor to bring the sod edge in a neat and clean manner to 1" below the elevation of edges of pavement and even with the elevation of edge of shrub areas. After placement of sod, a top dressing of clean sand shall be evenly applied over the entire surface and thoroughly washed, if determined necessary by the Architect. Top dressing will not be required on properly installed sod.
- C. Lay sod to form a solid mass with tightly fitted joints. Butt ends and sides of sod strips; do not overlap. Stagger strips to offset joints in adjacent courses. Tamp or roll lightly to ensure a smooth, even surface that is in contact with subgrade. Work sifted soil into minor cracks between pieces of sod; remove excess to avoid smothering of adjacent grass.
- D. Anchor sod on slopes with sod staples to prevent slippage.
- E. Water sod thoroughly with a fine spray immediately after planting.

### 3.4 SEEDING NEW LAWNS:

- A. Areas to be seeded shall be cultivated to a depth of 4" below finish grade and treated with 6-6-6 fertilizer (100% organic) with minor elements at a rate of 20 pounds per 1000 square feet. The fertilizer shall be thoroughly incorporated into the top 3" to 4" of soil. Argentine Bahia seed shall be applied to all areas at a rate of 12 pounds per 1000 square feet. Do not use wet seed or seed which is moldy or otherwise damaged in transit or storage. Provide and sow Brown Top Millet or Winter Rye seed as seasonally appropriate, in addition to the specified Argentina Bahia. Seeding operations shall conform to D.O.T. specifications, Section 981-1 "Seed" (blow hay and use cultipacker). Sow seed using a spreader or seeding machine. Do not seed when wind velocity exceeds 5-mph. Distribute seed evenly over entire area by sowing equal quantity in two directions at right angles to each other. Final lawn area shall be reasonably free of large clods, roots, and other material which will interfere with the work or subsequent mowing and maintenance operations. If there are areas that do not show evidence of uniform grass growth at the end of 8 weeks after seeding, the Contractor shall reseed in the originally specified manner, until uniform growth is achieved.
- B. Protect seeded slopes against erosion with erosion netting or other methods acceptable to the Architect.

### 3.5 MAINTENANCE:

- A. Begin maintenance immediately after planting.
- B. Maintain lawns for not less than the period stated below:
  - 1. All lawns - not less than the date of Final Completion.
  - 2. A minimum of one mowing of all grassed areas is required following the completion of sodding and irrigation system installation/sprinkler head adjustment.
  - 3. Maintain lawns by watering, fertilizing, weeding, mowing, trimming, and other operations such as rolling, regrading and replanting as required to establish a smooth, acceptable lawn, free of eroded or bare areas.

### 3.6 CLEANUP AND PROTECTION:

- A. During grassing work, keep pavements clean and work area in an orderly condition.

- B. Protect grassing work and materials from damage due to grassing operations, operations by other Contractors and trades and trespassers. Maintain protection during installation and maintenance periods. Treat, repair or replace damaged grass work as directed.

3.7 INSPECTION AND ACCEPTANCE:

- A. When grass work is completed, including maintenance, the Architect will, upon request, make an inspection to determine acceptability.
- B. When inspected grassing work does not comply with requirements, replace rejected work and continue specified maintenance until reinspected by the Architect and found to be acceptable. Remove rejected plants and grassing materials promptly from project site.

END OF SECTION 02820



## **SECTION 02831 - CHAIN LINK FENCING AND GATES**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of Contract apply to work of this Section.

#### **1.2 DESCRIPTION OF WORK**

- A. Extent of chain link fences and gates is indicated on drawings.

#### **1.3 QUALITY ASSURANCE**

- A. Provide chain link fences and gates as complete units controlled by a single source including necessary erection accessories, fittings, and fastenings.

#### **1.4 SUBMITTALS**

- A. Product Data: Submit manufacturer's technical data, and installation instructions for metal fencing, fabric, gates and accessories.

### **PART 2 - PRODUCTS**

#### **2.1 GENERAL**

- A. Dimensions indicated for pipe, roll-formed, and H-sections are outside dimensions, exclusive of coatings.
- B. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work include, but are not limited to, the following:
  - 1. Galvanized Steel Fencing and Fabric:
    - a. Allied Tube and Conduit Corp.
    - b. American Fence Corp.
    - c. Anchor Fence, Inc.
  - 2. Aluminized Steel Fencing and Fabric:
    - a. Page Fence Div./Page-Wilson Corp.
    - b. Cyclone Fence/United States Steel Corp.
    - c. or approved equal
  - 3. Aluminum Fencing and Fabric:

- a. Chain Link Fence Company of Pennsylvania.
- b. Security Fabricators, Inc.
- c. or approved equal

4. Barbed Type:

- a. American Fence Corp.
- b. Man Barrier Corp.

2.2 STEEL FABRIC

A. Fabric: No. 9 ga. (0.148" + 0.005") size steel wires, 2" mesh, with top selvages knuckled for fabric 60" high and under, and both top and bottom selvages twisted and barbed for fabric over 60" high.

1. Furnish one-piece fabric widths for fencing up to 12' high.
2. Fabric Finish: Galvanized, ASTM A 392, Class II, with not less than 2.0 oz. zinc per sq. ft. of surface.
3. Fabric Finish: Aluminized, ASTM A 491, Class II, with not less than 0.40 oz. aluminum per sq. ft. of surface.

2.3 FRAMING AND ACCESSORIES

A. Steel Framework, General: Galvanized steel, ASTM A 120 or A 123, with not less than 1.8 oz. zinc per sq. ft. of surface.

1. Fittings and Accessories: Galvanized, ASTM A 153, with zinc weights per Table I.

B. End, Corner and Pull Posts: Minimum sizes and weights as follows:

1. Up to 6' fabric height, 2.375" OD steel pipe, 3.65 lbs. per lin. ft., 3.5" x 3.5" roll-formed sections, 4.85 lbs. per lin. ft.
2. Over 6' fabric height, 2.875" OD steel pipe, 5.79 lbs. per lin. ft., or 3.5" x 3.5" roll-formed sections, 4.85 lbs. per lin. ft.

C. Line Posts: Space 10' o.c. maximum, unless otherwise indicated, of following minimum sizes and weights.

1. Up to 6' fabric height, 1.90" OD steel pipe, 2.70 lbs. per lin. ft. or 1.875" x 1.625" C-sections, 2.28 lbs. per lin. ft.
2. 6' to 8' fabric height, 2.375" OD steel pipe, 3.65 lbs. per lin. ft. or 2.25" x 1.875" H-sections, 2.64 lbs. per lin. ft.

3. Over 8' fabric height, 2.875" OD steel pipe, 5.79 lbs. per lin. ft. or 2.25" x 1.875" H-sections, 3.26 lbs. per lin. ft.
- D. Gate Posts: Furnish posts for supporting single gate leaf, or one leaf of a double gate installation, for nominal gate widths as follows:
- | 1. Leaf Width   | Gate Post   | lbs./lin. ft. |
|-----------------|---|---------------|
| Up to 6'        | 3.5" x 3.5" roll-formed section or 2.875" OD pipe | 4.85<br>5.79  |
| Over 6' to 13'  | 4.000" OD pipe                                    | 9.11          |
| Over 13' to 18' | 6.625" OD pipe                                    | 18.97         |
| Over 18'        | 8.625" OD pipe                                    | 28.55         |
- E. Top Rail: Manufacturer's longest lengths, with expansion type couplings, approximately 6" long, for each joint. Provide means for attaching top rail securely to each gate corner, pull and end post.
1. 1.66" OD pipe, 2.27 lbs. per ft. or 1.625" x 1.25" roll-formed sections, 1.35 lbs. per ft.
- F. Tension Wire: 7-gage, coated coil spring wire, metal and finish to match fabric.
1. Locate at bottom of fabric.
- G. Wire Ties: 11 ga. galvanized steel or 11 ga. aluminum wire, to match fabric core material.
- H. Post Brace Assembly: Manufacturer's standard adjustable brace at end and gate posts and at both sides of corner and pull posts, with horizontal brace located at mid-height of fabric. Use same material as top rail for brace, and truss to line posts with 0.375" diameter rod and adjustable tightener.
- I. Post Tops: Provide weathertight closure cap with loop to receive tension wire or top rail; one cap for each post.
- J. Stretcher Bars: One-piece lengths equal to full height of fabric, with minimum cross-section of 3/16" x 3/4". Provide one stretcher bar for each gate and end post, and 2 for each corner and pull post, except where fabric is integrally woven into post.
- K. Stretcher Bars Bands: Space not over 15" o.c., to secure stretcher bars to end, corner, pull, and gate posts.
- L. Barbed Wire Supporting Arms: Manufacturer's standard barbed wire supporting arms, metal and finish to match fence framework, with provision for anchorage to posts and attaching 3 rows of barbed wire to each arm. Supporting arms may be

either attached to posts or integral with post top weather cap and must be capable of withstanding 250 lbs. downward pull at outermost end. Provide following type:

1. Single 45 deg. arm; for 3 strands barbed wire, one for each post.
- M. Barbed Wire: 2 strand, 12-1/2 ga. wire with 14 ga. 4-point barbs spaced not more than 5" o.c., metal and finish to match fabric.
- N. Barbed Tape: Continuous helical coils of barbed stainless steel tape, fabricated from .025" thick x 1" wide austenitic stainless steel with 4 needle sharp barbs on 4" centers and permanently clenched to .098" diameter core wire of high tensile zinc-coated steel. Adjacent loops clipped together to limit extension of coil. Provide coil diameter, type and configuration as indicated; if not otherwise indicated, provide 24" diameter, single concertina type coil.

## 2.4 GATES

- A. Fabrication: Fabricate perimeter frames of gates from metal and finish to match fence framework. Assemble gate frames by welding or with special fittings and rivets, for rigid connections, providing security against removal or breakage connections. Provide horizontal and vertical members to ensure proper gate operation and attachment of fabric, hardware and accessories. Space frame members maximum of 8' apart unless otherwise indicated.
1. Provide same fabric as for fence, unless otherwise indicated. Install fabric with stretcher bars at vertical edges and at top and bottom edges. Attach stretchers bars to gate frame at not more than 15" o.c.
  2. Install diagonal cross-bracing consisting of 3/8" diameter adjustable length truss rods on gates to ensure frame rigidity without sag or twist.
  3. Where barbed wire is indicated above gates, extend end members of gate frames 1'-0" above to member and prepare to receive 3 strands of wire. Provide necessary clips for securing wire to extensions.
- B. Swing Gates: Fabricate perimeter frames of minimum 1.90" OD pipe.
- C. Gate Hardware: Provide hardware and accessories for each gate, galvanized per ASTM A 153, and in accordance with the following:
1. Hinges: Size and material to suit gate size, non-lift-off type, offset to permit 180 deg. gate opening. Provide 1-1/2 pair of hinges for each leaf over 6' nominal height.
  2. Latch: Forked type or plunger-bar type to permit operation from either side of gate, with padlock eye as integral part of latch.

3. Keeper: Provide keeper for vehicle gates, which automatically engages gate leaf and holds it in open position until manually released.
  4. Double Gates: Provide gate stops for double gates, consisting of mushroom type flush plate with anchors, set in concrete, and designed to engage center drop rod or plunger bar. Include locking device and padlock eyes as integral part of latch, permitting both gate leaves to be locked with single padlock.
- D. Sliding Gates: Provide manufacturer's standard heavy-duty inverted channel track, ball-bearing hanger sheaves, overhead framing and supports, guides, stays, bracing, hardware, and accessories as required.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. Do not begin installation and erection before final grading is completed, unless otherwise permitted.
- B. Excavation: Drill or hand excavate (using post hole digger) holes for posts to diameters and spacings indicated, in firm, undistributed or compacted soil.
  1. If not indicated on drawings, excavate holes for each post to minimum diameters as recommended by fence manufacturer, but not less than 4 times largest cross-section of post.
  2. Unless otherwise indicated, excavate hole depths approximately 3" lower than post bottom, with bottom of posts set not less than 36" below finish grade surface.
- C. Setting Posts: Center and align posts in holes 3" above bottom of excavation.
  1. 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" above grade and trowel to a crown to shed water.
- D. Top Rails: Run rail continuously through post caps, bending to radius for curved runs. Provide expansion couplings as recommended by fencing manufacturer.
- E. Center Rails: Provide center rails where indicated. Install in one piece between posts and flush with post on fabric side, using special offset fittings where necessary.
- F. Brace Assemblies: Install braces so posts are plumb when diagonal rod is under proper tension.

- G. Tension Wire: Install tension wires through post cap loops before stretching fabric and tie to each post cap with not less than 6 ga. galvanized wire. Fasten fabric to tension wire using 11 ga. galvanized steel hog rings spaced 24" o.c.
- H. Fabric: Leave approximately 2" 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 in tension after pulling force is released.
- I. Stretcher Bars: Thread through or clamp to fabric 4" o.c., and secure to posts with metal bands spaced 15" o.c.
- J. Barbed Wire: Pull wire taut and install securely to extension arms and secure to end post or terminal arms in accordance with manufacturer's instructions.
- K. Barbed Tape: Install barbed tape in configurations indicated in accordance with manufacturer's recommendations and securely fasten to fencing to prevent movement or displacement.
- L. Gates: 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.
- M. Tie Wires: Use U-shaped wire, conforming to diameter of pipe to which attached, clasping pipe and fabric firmly with ends twisted at least 2 full turns. Bend ends of wire to minimize hazard to persons or clothing.
  - 1. Tie fabric to line posts, with wire ties spaced 12" o.c. Tie fabric to rails and braces, with wire ties spaced 24" o.c. Tie fabric to tension wires, with hog rings spaced 24" o.c.
- N. Fasteners: Install nuts for tension bands and hardware bolts on side of fence opposite fabric side. Peen ends of bolts or score threads to prevent removal of nuts.

END OF SECTION

## **SECTION 02900 - IRRIGATION SYSTEM**

### PART I - GENERAL

#### 1.1 DESCRIPTION OF WORK:

- A. The work covered under this section includes supplying and installing all materials and equipment required for a complete operational automatic irrigation system.
- B. The information herein contained indicates the types of materials, quality of workmanship, and manner of protection, which shall be complied with in effecting the irrigation system.
- C. Completion of work shall mean the full and exact compliance and conformity with all the provisions of the Contract Documents.

#### 1.2 SUBMITTALS: See DIVISION ONE – SUBMITTALS and subsection 1.7 below.

#### 1.3 RELATED WORK:

- A. The Contractor shall fully acquaint himself with related planting, paving, site, and utilities work described elsewhere in the Contract Documents to preclude any misunderstandings and to facilitate a trouble-free irrigation system.
- B. Electrical service to controller and well shall be provided by electrical subcontractor in compliance with NEC requirements. Coordinate with DIVISION 16 for voltage requirements.
- C. See SECTION 02800 - LANDSCAPING and SECTION 02820 - GRASSING.

#### 1.4 QUALITY ASSURANCE:

- A. Landscape irrigation system installation shall only be performed by a firm that is regularly engaged full time in the installation of underground landscape irrigation systems. Crews shall be controlled and directed by a foreman who is thoroughly familiar with the type of materials being installed and the manufacturer's recommended methods of installation.

#### 1.5 DESIGN MODIFICATIONS:

- A. Slight layout modifications may be made only as necessary to meet field conditions and only as acceptable to the Architect. Piping shown on drawings is diagrammatically routed for clarity - route to avoid conflict with specimen plants and adjust as necessary to landscape construction.
- B. Design Criteria: The Architect shall have the right, at any stage of the

operations, to reject any and all work and materials which, in his opinion, do not comply with the requirements of the Contract Documents. Such rejected work or material shall be immediately removed from the site and acceptable work or material substituted in its place.

- C. Contractor shall be responsible for verification at the site of all conditions and dimensions shown on the drawings prior to commencement of work.

1.6 REQUIREMENTS OF REGULATORY AGENCIES:

- A. Work shall comply with applicable codes, ordinances and regulations of all governing authorities.

1.7 SUBMITTALS:

- A. After completion of piping installation, the Contractor shall furnish to the Architect a reproducible "AS-BUILT" drawing showing all sprinkler heads, valves, and pipelines to reasonable scale, and provide a minimum of two dimensions taken from fixed obvious objects to each automatic and manual control valve, and quick coupling valve.

- 1. The Contractor shall also furnish a drawing showing a graphic representation of sprinkler zones and recommendations for controller time settings for each valve.

- B. Instruction sheets and parts lists covering all operating equipment shall be bound into folders and furnished to the Architect.

1.8 UTILITIES:

- A. Prior to excavation, verify in the field the location and depth of all new and existing utilities and other work which may be damaged by the Contractor's construction.

1.9 GUARANTEES:

- A. The Contractor shall furnish warranties, in writing, certifying that the quality and workmanship of all materials and installation furnished is in accordance with the Contract Documents and in accordance with the original manufacturer's warranties.

- 1. The Contractor shall be responsible for the fulfillment of all manufacturers' warranties.
  - 2. The Contractor shall guarantee materials and workmanship for a period of one year from date of Final Acceptance by Owner.

- B. The Contractor is responsible for protection of the work until the date of Final Completion.



- C. The Contractor shall provide the Owner with a written guarantee.

## PART II – PRODUCTS

### 2.1 MATERIALS:

- A. Materials and equipment shall be new and shall operate at the manufacturer's published capacities.

### 2.2 PIPE:

- A. Comply with the following unless otherwise indicated: All PVC mainline pipe shall be CL 200 or Schedule 40 ASTM D-1785, all PVC lateral pipe shall be CL 200, Polyvinyl Chloride (PVC 1120) ASTM D-1784, Type 1, NSF approved. If water supply is re-use water then purple pipe and fittings shall be used.
- B. All crossings (sleeves) under paved areas shall be Schedule 40 PVC, ASTM D-1785.
- C. For PVC plastic pipe, ASTM D-2466 socket fittings with ASTM A-2564 solvent cement.

### 2.3 CONTROLLER:

- A. The Contractor shall furnish electric controllers(s) as indicated on the drawings and as specified herein.
1. The controller(s) shall be installed in the area(s) shown on the drawings.
  2. All electrical connections are the responsibility of the Contractor.
  3. A typewritten plastic laminated legend shall be attached inside the controller(s) door stating the areas covered by each remote control valve.

### 2.4 SPRINKLER HEADS:

- A. Sprinkler heads shall be of the type shown or scheduled on the drawings.

### 2.5 RISERS AND SWING JOINTS:

- A. Risers and swing joints shall be as detailed on the drawings.

### 2.6 FLEX CONNECTIONS:

- A. These connections shall be PVC flex pipe with glued fittings, or approved equal.

### 2.7 GATE VALVES:

- A. Shall be all brass body, or approved equal.

2.8 REMOTE CONTROL VALVES:

- A. Valves shall be as specified on the drawings. Use Teflon tape only on threaded connections.

2.9 VALVE BOXES:

- A. Valve boxes shall be Ametek/Armor AVB-12 or approved equal with cover installed flush with finish grade. If water supply is re-use water then purple box and lid shall be provided.

2.10 CONTROL WIRING:

- A. All wiring to automatic circuit valves shall be UF-14 direct burial wire of a different color than the black and white wires used on the 115 volt AC power.
- B. Wiring from the controller to the valves shall be installed in same trench as the mainline where possible.
- C. All splices shall be made with King “One-step” connectors, or approved equal.
- D. All wire shall be furnished in minimum 2,500' reels and spliced only at valve or tee locations.

2.11 BACKFLOW PREVENTER:

- A. Backflow preventer (if utilized/shown) shall be of the type shown on drawings.

2.12 WELL:

- A. The well shall be of the type as per the details, notes and specifications shown on drawings.

2.13 DRIP TUBING & ACCESSORIES:

- A. Drip tubing and associated accessories shall be of the type as per the details, notes and specifications shown on the drawings.

PART III – EXECUTION

3.1 INSPECTION:

- A. Contractor must examine the areas and conditions under which landscape irrigation system is to be installed and notify the Architect in writing of conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected.

3.2 COORDINATION:

- A. Crossings under paved areas as indicated, shall be installed by the Contractor.
- B. Crossings shall be installed prior to construction of paving.
- C. The Contractor shall be responsible for coordinating his work with all other parties involved with the project, and shall coordinate the supply of electrical power to the Timing Device (controller).
- D. The Contractor shall be responsible for full and complete coverage of all irrigated areas and shall make any necessary minor adjustments at no additional cost to the Owner.

3.3 EXCAVATING AND TRENCHING:

- A. Perform all excavations as required for the installation of the work included under this section, including shoring of earth banks to prevent cave-ins.
- B. Restore all surfaces, existing underground installations, etc., damaged or cut as a result of the excavations to their original conditions.
- C. Trenches for pipelines shall be made of sufficient depth to provide the minimum cover from finish grade as follows:
  - 18" minimum cover over main lines.
  - 18" minimum cover over control wires.
  - 12" minimum cover over lateral lines to heads.
- D. Where possible, install pipe adjacent to curbs or paving to minimize interference with plants and their roots.
- E. Keep trenches free of obstruction and debris. Remove excess soil from the site and leave grade as it was prior to irrigation system installation.
- F. Piping shall be routed around shrubs, trees and other permanent obstacles.

3.4 PIPE LINE ASSEMBLY:

- A. Install plastic pipe and drip tubing as recommended by the manufacturer and provide for expansion and contraction. Cut plastic pipe square. Remove burrs at cut ends prior to installation so that a smooth unobstructed flow will be obtained.
- B. Install remote control valves at locations no closer than 12" to weld edges, buildings, and walls. Plastic pipe fittings shall be solvent welded using solvents and methods as recommended by manufacturer of the pipe, except where

screwed connections are required. Pipe and fittings shall be thoroughly cleaned of dirt, dust and moisture before applying solvent with a nonsynthetic bristle brush. Care should be taken not to use an excess amount of solvent, thereby causing a burr or obstruction to form on the inside of the pipe. Allow the joints to set at least 24 hours before applying pressure on PVC pipe.

- C. Sprinkler heads of large rotary gear-driven type shall be installed so that the tip is slightly above finish grade. If finish grade has not been established, set the top 4" above grade and lower when finish grade has been achieved. Heads along curbs and walks shall be set flush to within 1/8" and 12" away from curb or walk. Adjust heads having an adjustment stem, for the proper radius and throw for the area involved.
- D. All control wires shall be installed in a neat and orderly fashion underneath the main and lateral pipes, if possible. 10" loops shall be provided at each valve where control wires are connected. All piping and wiring passing under existing or future paving, construction, etc., shall be encased in sleeving as specified, extending at least 12" beyond edges of paving base or construction.

### 3.5 BACKFILLING AND COMPACTING:

- A. After systems are approved, or sections thereof, backfill excavations and trenches with clean soil, free of rubbish. Dress off all areas to finish grades.
- B. Balance and adjust the irrigation system components for efficient, proper operation. This includes controller synchronization as well as individual controller stations, valves and sprinkler head adjustments.

### 3.6 LABELS:

- A. Number each zone valve box on inside of valve box with a black waterproof marker for reference. Numbers shall match the zone numbers on the drawings.
- B. Number each zone valve control wire at the controller with a waterproof marker and tags. Numbers shall match the zone numbers on the drawings.

### 3.7 DEMONSTRATION:

- A. Provide a complete demonstration to the Owner's Authorized Representative of the operation of all components of the irrigation system.
- B. Provide complete typewritten instructions for operation including recommended watering times, duration and preventative maintenance.

### 3.8 MAINTENANCE:

- A. Maintain the irrigation system until the date of Final Acceptance by Owner.
- B. Maintenance shall include work, materials and replacements necessary to insure a complete properly operating system.

3.9 OWNERS RESPONSIBILITY FOR MAINTENANCE:

- A. It will be the Owner's responsibility to maintain the system in working order during the guarantee period, performing necessary minor maintenance, keeping grass from obstructing the sprinkler heads and preventing vandalism and damage during the landscape maintenance operation.

3.10 CLEAN-UP:

- A. Upon completion and prior to inspection of the work, clear the site of debris, superfluous materials and equipment.

END OF SECTION 02900

## **SECTION 02910 – SEWAGE FORCEMAINS**

### **PART 1 - GENERAL**

#### **1.1 DESCRIPTION OF WORK**

- A. Drawings and general provisions of Contract, including General and Supplementary conditions apply to this section.
- B. Refer to Division 2 selection "Earthwork - Underground Utilities" for excavation and backfill required for underground utilities; not work of this section.

#### **1.2 QUALITY ASSURANCE**

- A. **Manufacturer Qualifications:** Firms regularly engaged in manufacturer of sewage forcemain systems materials and products, of types and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.
- B. **Installer's Qualifications:** Firm with at least 3 years of successful installation experience on projects with sewage forcemain piping work similar to that required for project.
- C. **Product Data:** Submit manufacturer's technical product data and installation instructions for sewage forcemain system materials and products.
- D. **Shop Drawings:** Submit shop drawings for sewage forcemain systems, showing piping materials, size, locations, and elevations. Include details of underground structures, connections, thrust blocks, and anchors. Show interface and spatial relationship between piping and proximate structures.
- E. **Record Drawings:** At project closeout, submit record drawings of installed sewage forcemain system piping and products.
- F. **Maintenance Data:** Submit maintenance data and parts lists for sewage forcemain system materials and products. Include this data, product data, shop drawings, and record drawings in maintenance manual; in accordance with requirements of Division 1.
- G. **Environmental Compliance:** Comply with applicable portions of Florida Department of Environmental Regulation, Orange County Public Utilities, and Orange County Engineering.

### **PART 2 - PRODUCTS**

#### **2.1 IDENTIFICATION**

- A. **Underground-Type Plastic Line Markers:** Manufacturer's standard permanent, bright-colored, continuous-printed plastic tape, intended for direct-burial service; not less than 6" wide x 4 mils thick. Provide brown tape with black printing reading "CAUTION SEWAGE FORCEMAIN BURIED BELOW".
- B. Provide #10 AWG copper conductivity wire over underground non-metallic forcemains.

Include termination above ground at equipment or valves.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering plastic line markers which may be incorporated in the work include, but are not limited to, the following:

Allen Systems Inc.  
Seton Name Plate Corp.

## 2.2 PIPE & FITTINGS

- A. Iron Pipe: Pipe shall be ductile iron (DI) with minimum thickness of Class 51 for 3 and 4 inch diameter pipe and Class 50 for larger pipe. Fittings may be ductile iron or gray iron (GI) unless otherwise noted herein or in the Drawings. The materials shall be as follows:
  1. Pipe - ANSI A21.51 (AWWA C151)
  2. Fittings - ANSI A21.10 (AWWA C110)
  3. Joints - Mechanical & Push-on, ANSI A21.11 (AWWA C2111)
  4. Joints - Flanges ANSI A21.10 & A21.15 (AWWA C110 & C115) Class 125 and 1/8 inch full faced rubber gaskets.
  5. Restrained joints - Ductile iron mechanical joint retainer glands approved equal to American Cast Iron Pipe Co.
  6. Flexible joints - Boltless with 15 joint deflection per applicable portions of ANSI A21.10 (AWWA C110) approved equal to "Flex-Lok" by American Cast Iron Pipe Co.
  7. Bolts & Nuts - Bolts, ANSI B18.21 Nuts, B18.2.1; low carbon steel per ASTM A307, Grade B.
  8. Coatings, Linings & Encasement (DIP): All pipe and fittings shall be bituminous coated inside and out as specified in the ANSI Specifications cited in B-1 except where special painting or lining is called for. Polyethylene encasement shall be per ANSI 21.5 (AWWA C105).
  9. Where protective interior lining is called for, use 20 mil (minimum dry thickness) virgin polyethylene per ASTM D1248 compounded with an inert filler and with sufficient carbon black to resist ultraviolet rays during above ground storage, heat bonded to pipe and fittings, approved equal to "polybond" by American Cast Iron Pipe Company. Polyethylene Encasement, where required, shall be per ANSI A21.5 (AWWA C105).
- B. Polyvinyl Chloride Pipe (PVC) (4 inch to 12 inch): AWWA C900, DR 25, Pressure Class 100, integral bell and spigot with elastomeric gaskets per ASTM D1869 and ASTM E477. PVC pipe shall use cast iron fittings per Paragraph A.
- C. Plug Valves: Semi-steel body, non-lubricated, eccentric type, with resilient faced plugs capable of drip-tight shut-off at the rated pressure applied at either port. Exposed valves shall have flanged connections; buried valves shall have mechanical joint connections. Provide gear actuators for valves 10 inches or larger. Valves and appurtenances shall be Series 100 as manufactured by DeZurik Corp., Sartell, Minn., or approved equal.
- D. Check Valves: Iron body, bronze-mounted, stainless steel hinge pin, outside spring operated, swing non-slab type, and equipped with removable inspection covers. Units shall be rated for 150 psi minimum working pressure and shall permit full flow area equal

to that of the connecting pipe. Valves shall be approved equal to M & H.

- E. Air Release and Vacuum Valves: Cast iron body, minimum 150 psi working pressure, equipped with vacuum ball to prevent air return, two-inch inlet and 1 inch blow off valve approved equal to APCO 400/401.
- F. Tapping Sleeves and Valves: Mechanical joint type with flanged outlet per ANSI B16.1, Class 125 approved equal to M & H Fig. 74-M (Tapping Sleeve) manufactured by Dresser Industries, Inc., Anniston, Alabama. Valves shall be gate valves as specified herein and shall be specially designed for wet tapping and be compatible with connecting sleeve.
- G. Gate Valves: Iron body, bronze-mounted AWWA C500, double disc, non-rising stem type, equipped with 2 inch square cast iron wrench nut.
- H. Valve Boxes: Adjustable cast iron suitable sized to the valve with minimum diameter of 5 inches. Cover shall have the work "SEWER" legibly cast into the face. Boxes shall be suitable for H-20 loading and shall be approved equal to Clow, M & H or U.S. Foundry.

### PART 3 - EXECUTION

#### 3.1 GENERAL

- A. Excavation and backfill including sheeting and bracing, dewatering, bedding and foundation, and furnishing and disposal of materials shall be as specified in Section 02210 of these Standard Specifications, "Earthwork - Underground Utilities" with any additional requirements included herein.
- B. Pipe Laying: Lay all pipe "in the dry" along straight lines and grades between fittings, manholes, or other defined points, unless definite alignments deflections or grade changes are noted in the Drawings. Maintain a 3 foot minimum depth of cover over the top of pipe, unless otherwise noted in the Drawings. Maintain all materials, clean and protect all coatings from damage. Maintain the interior of the pipe, clean and free of dirt and debris. When work is not in progress, plug all open ends. Underground piping shall not be driven to grade by striking it with an unyielding object. Provide bell holes in the bedding to allow uniform load bearing along the pipe barrel.
- C. Subaqueous pipe laying may be permitted with prior approval of the Engineer where conditions make it impracticable to lay pipe "in the dry".
- D. Push-on Joints: The pipe bell and spigot shall be thoroughly cleaned immediately prior to inserting the gasket and jointing. Assure that the gasket is properly faced and positioned. Lubricate in accordance with manufacturer's recommendations. Protect pipe against damage from jointing equipment by using timber headers, etc.
- E. Mechanical Joints: Wipe clean the socket and plain end. The plain end, socket, and gasket shall be washed with a soap solution immediately prior jointing. Maintain the joint straight during assembly with the gasket pressed firmly and evenly into the recess. Bolts shall be tightened such that the gland remains reasonably parallel to the flange by alternating from bolt to bolt in cycles. The required bolt size (pipes 4 inch to 24 inch diameter) is 3/4 inch torques to 75-90 ft-lbs.



- F. Flange Joints: Make all flanged joints tight, without applying undue strain upon the joint or other appurtenances. Fit joints such that contact surfaces bear uniformly on the gasket with relatively uniform bolt stresses.
- G. Pipe Cutting: Cutting pipe for the insertion of valves, fittings, or closure pieces shall be done in a neat workman like manner without damaging pipe coatings or linings. Cut the pipe with an abrasive pipe saw, rotary wheel cutter, guillotine pipe saw or milling wheel saw. Cut ends and rough edges shall be ground smooth and for push-on joint connections, the cut end shall be beveled.
- H. Pipe Restraint: All plugs, caps, tees, and bends, unless otherwise specified, shall be restrained by thrust block reaction backing and/or the use of tie rods, retainer glands and/or restrained joints as shown in the Drawings and Standard Detail Drawings. Thrust blocking shall be placed between solid ground and the fitting to be anchored. Where concrete is to be placed around bolted joints, provide a sheet of 3 mil (minimum) polyethylene between the fitting and the concrete. Where soil bearing is inadequate to provide proper thrust blocking, Contractor shall provide mechanical restraint as directed by the Engineer. Protect tie rods, clamps, or other components of dissimilar metal against corrosion by hand application of a bituminous coating. Backfilling over pipe restraints shall not proceed until inspected by the Engineer.
- I. Polyethylene Encasement: When polyethylene encasement is specified for ductile iron pipe it shall be installed in accordance with Section 5-4 of ANSI A21.5 (AWWA C105).
- J. Above Ground Pipe Support: Support exposed systems as necessary to hold the piping and appurtenances in a firm, substantial manner to the required lines and grades indicated in the Drawings, with no undue piping stresses transmitted to equipment. Support all pipe above ground outside of buildings by concrete supports.
- K. Tapping: Tapping shall be by tapping sleeve and valve installed with a tapping device designed for the pipe material.
- L. Valves: Carefully inspect all valves, opened wide, and then tightly closed, and all the various nuts and bolts for tightness. Take special care to prevent joint materials, stones, and other substances from becoming lodged in the valve seat. Any valve that does not operate correctly shall be replaced. Install at the locations, to the sizes, and elevations called for in the Drawings.
- M. Unless otherwise noted in the Drawings, set valve stems vertically above the center-line of the pipe. Where extension stems are required within valve boxes, provide insert stems.
- N. Valve Boxes: Center all valve boxes over the operating nut of underground valves to permit a valve wrench to be easily fitted to the nut. Set top of boxes to final grade. The valve box shall not transmit surface loads directly to either the pipe or valve. Use excessive care to prevent earth and other materials from entering the boxes. Any valve box that becomes out of alignment or is not to grade, shall be dug out and adjusted. A concrete collar shall be provided as shown in the Standard Detail Drawings.
- O. Air & Vacuum Valves: Install air and vacuum valves in manhole structures as shown in the Standard Detail Drawings.

P. Hydrostatic Testing: This test shall be performed by the Contractor with his labor and equipment in the presence of the Engineer and Orange County Representative. No testing will proceed until all thrust blocks are cured or restraining devices installed. Clean and flush all piping thoroughly prior to testing. During filling of water all air will be carefully permitted to escape through release cocks installed as required.

Q. Perform the hydrostatic test at 100 psi for a period of two (2) hours as per Section 4, AWWA C600. The maximum allowable leakage shall not be less than that determined by the following formula:

$$L = \frac{(N) (D) (P)^{0.5}}{7400} = \text{allowable leakage in gal. per hr.}$$

$$L = 0.00270 ND; \text{ for 100 psi test for 2 hours}$$

N = Number of joints in the section tested

D = Nominal pipe diameter in inches

P = Average test pressure maintained during the leakage test in psig (gauge)

R. During the two (2) hour period of the test, the Contractor shall maintain a continuous pressure of 100 psi, by means of a pump taking supply from a container suitable for the measurement of water loss. Should the test fail, the leak will be located and repaired and the test performed again until it meets the above specified limits.

END OF SECTION

## **SECTION 03100 - CONCRETE FORMWORK**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

- A. The General Conditions of the Contract, including General Requirements of Division 1 apply to the work specified in this Section.

#### **1.2 DESCRIPTION**

- A. The work under this Section of the Specifications includes all labor, materials, equipment and services necessary to complete the concrete formwork as shown on the drawings and herein specified.

#### **1.3 QUALITY ASSURANCE**

- A. Work performed shall be in accordance with the American Concrete Institute (A.C.I. 347), American Plywood Association (A.P.A., latest edition, "Plywood for Concrete Forming").

### **PART 2 PRODUCTS**

#### **2.1 MATERIALS**

##### **A. Forms:**

1. Framing. Kiln-dried softwood lumber, PS 20-70.
2. Plyform. B-B Plyform, sanded, Class 1, EXT-APA Grade, PSI-66. Fiber or metal forms may be used in lieu of plywood, subject to Architect's approval.

- B. Rustication, Bevels, Chamfers: Mill from Northern White Pine, smooth and free of irregularities. Preformed P.V.C. strips may be used for corner chamfers.

- C. Shores: Patented shores of adequate strength and bracing to safely support imposed loads.

- D. Form Oil: Non-staining, paraffin-base oil having a specific gravity of between 0.8 and 0.9.

- E. Form Ties: Bolts, rods, or patented devices having a minimum tensile strength of 3,000 lbs., adjustable in length, free of lugs which would leave a hole larger than 5/8" diameter and having a full 1" depth of break-back.

- F. Expansion Joint Filler: Premolded mastic strips, asphaltic impregnated A.S.T.M. D-1751.

### PART 3 - EXECUTION

#### 3.1 RESPONSIBILITY

- A. Contractor shall be fully responsible for adequacy of formwork in its entirety. Forms shall support loads they will be required to sustain and shall maintain their dimensional and surface correctness to provide members as required by drawings.

#### 3.2 INSTALLATION

- A. Build forms to conform to shapes, lines and dimensions of detailed members of concrete construction. Set to line and grade, and brace and secure to withstand placing of concrete and maintain their shape and position.
- B. Construct forms with care to produce concrete surfaces without unsightly or objectionable form marks in exposed concrete surfaces.
- C. Thoroughly clean surfaces of form material and remove nails before reuse. Do not reuse damaged or worn forms. Coat contact surfaces of forms with non-staining form oil prior to placing metal reinforcement.
- D. Immediately before placing concrete, clean forms of chips, sawdust, and other debris. After removal of forms, remove form ties, wires, and other defects and patch.
- E. Inserts and Accessories: Make provisions for required installation of accessories, bolts, hangers, sleeves, hurricane anchors and inserts cast in concrete.
- F. Obtain templates or instructions for installation of built-in items. Place expansion joints where detailed.
- G. Removal of Forms: Forms shall be removed in such a manner as to insure complete safety of structure and, provided concrete is sufficiently hard so as not to be injured itself. Where structure as a whole is supported on shores, beams, columns, similar vertical forms may be removed after 24 hours; horizontal forms at roof slab shall remain for 14 days. In no case shall supporting forms, shoring be removed until members have acquired sufficient strength to support safely their weight and load thereon.

#### 3.3 DEFECTIVE WORK

- A. Should misalignment of forms or screeds, excessive deflection of forms or

displacement of reinforcement occur during concrete placing, corrective measures shall be made to insure acceptable lines.

- B. If any forms bulge or show deflection which, in the Architect's opinion is excessive, the concrete shall be removed and the work rebuilt.

3.4 ADJUST AND CLEAN:

- A. Repair any form members which have been damaged prior to placement of concrete. Maintain forms in excellent condition prior to placement, during placement, and during curing of all concrete.

END OF SECTION 03100

## **SECTION 03200 - CONCRETE REINFORCEMENT**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS:**

- A. The general provisions of the Contract, including General and Supplementary Conditions and General Requirements (if any), apply to the work specified in this Section.

#### **1.2. DESCRIPTION OF WORK:**

- A. The extent of concrete reinforcement is shown on the drawings and in schedules.
- B. The work includes fabrication and placement of reinforcement for cast-in-place concrete, including bars, welded wire fabric, ties and supports.
- C. Related Work Specified Elsewhere: Site Work Division 2, Reinforcement for Unit Masonry: Division 4.

#### **1.3 QUALITY ASSURANCE:**

- A. Codes and Standards: Comply with requirements of the following codes and standards, except as herein modified:
- B. American Welding Society, AWS D12.1 "Recommended Practices for Welding Reinforcing Steel, Metal Inserts and Connections in Reinforced Concrete Construction".
- C. Concrete Reinforcing Steel Institute, "Manual of Standard Practice:..
- D. American Concrete Institute, ACI 318 "Building Code Requirements for Reinforced Concrete".

#### **1.4 SUBMITTALS:**

- A. Comply with requirements of Section 01300 Submittals.
- B. Manufacturer's Data; Concrete Reinforcement: Submit manufacturer's 6 copies of product data, specifications, and installation instructions for proprietary materials and reinforcement accessories.
- C. Shop Drawings; Concrete Reinforcement: Submit 6 sets of blueprints and one set of sepias of shop drawings for fabrication, bending, and placement of concrete reinforcement. Comply with the ACI 315 "Manual of Standard

Practice for Detailing Reinforced Concrete Structures". Show bar schedules, stirrup spacing, diagrams of bent bars, arrangements and assemblies, as required for the fabrication and placement of concrete reinforcement.

#### 1.5 DELIVERY, HANDLING AND STORAGE:

- A. Deliver reinforcement to the project site bundled, tagged and marked. Use metal tags indicated bar size, lengths, and other information corresponding to markings shown on placement diagrams.
- B. Store concrete reinforcement materials at the site to prevent damage and accumulation of dirt or excessive rust.

### PART 2 - PRODUCTS

#### 2.1 MATERIALS:

##### A. Reinforcing Bars : ASTM A-615, deformed and as follows:

- 1. Provide Grade 60 for bars No. 3 to 18, except as otherwise indicated.
- 2. Provide No. 2 reinforcing consisting of round carbon steel bars complying with ASTM A-675.

##### B. Steel Wire: ASTM A-82, galvanized.

C. Welded Wire Fabric: ASTM A-185. Provide galvanized welded wire fabric complying with ASTM A-123, hot-dip galvanized after fabrication. Install in all slabs on grade and in topping over the hollow core slabs.

D. Column Spirals: Plain, cold-drawn wire, ASTM A-82, or hot-rolled rods for spirals, ASTM A-615.

E. Supports for Reinforcement: Bolsters, chairs, spaces and other devices for spacing, supporting and fastening reinforcement in place.

F. Use wire bar type supports complying with CRSI recommendations, unless otherwise indicated. Do not use wood, brick, and other unacceptable materials.

G. For slabs on grade, use supports with sand plates or horizontal runners where base material will not support chair legs.

#### 2.2 FABRICATION:

- A. General: Fabricate reinforcing bars to conform to required shapes and dimensions, with fabrication tolerances complying with CRSI "Manual of Standard Practice". In case of fabricating errors, do not re-bend or straighten reinforcement in a manner that will injure or weaken the material.
- B. Unacceptable Materials: Reinforcement with any of the following defects will not be permitted in the work:
  - 1. Bar lengths, depths and beds exceeding CRSI fabrication tolerances.
  - 2. Bend or kinks not indicated on drawings or final shop drawings.
  - 3. Bars with reduced cross-section due to excessive rusting or other cause.

### PART 3 - EXECUTION

#### 3.1 INSPECTION:

- A. The Installer must examine the conditions under which concrete reinforcement is to be placed, and notify the Contractor in writing of unsatisfactory conditions. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to the Installer.

#### 3.2 INSTALLATION:

- A. Comply with the specified codes and standards, and Concrete Reinforcing Steel Institute recommended practice for "Placing Reinforcing Bars", for details and methods of reinforcement placement and supports, and as herein specified.
- B. Clean reinforcement to remove loose rust and mill scale, earth, ice, and other materials which reduce or destroy bond with concrete.
- C. Accurately position, support, and secure reinforcement against displacement by formwork, construction, or concrete placement operations. Locate and support reinforcing by metal chairs, runners, bolsters, spacers and hangers, as required.
- D. Place reinforcement to obtain the minimum coverages for concrete protection. Arrange, space, and securely tie bars and bar supports together with 16 gauge wire to hold reinforcement accurately in position during concrete placement operations. Set wire ties so that twisted ends are directed away from exposed concrete surfaces.
- E. Install welded wire fabric in as long lengths as practicable. Lap adjoining pieces at least one full mesh and lace splices with 16 gauge wire. Do not make end laps midway between supporting beams, or directly over beams of



- continuous structures. Offset end laps in adjacent widths to prevent continuous laps.
- F. Provide sufficient numbers of supports and of strength to carry reinforcement. Do not place reinforcement bars more than 2" beyond the last leg of any continuous bar support. Do not use supports as bases for runways for concrete conveying equipment and similar construction loads.
- G. Splices: Provide standard reinforcement splices by lapping ends, placing bars in contact, and tightly wire tying. Comply with requirements of ACI 318 for minimum lap of spliced bars.

END SECTION 03200

## **SECTION 03300 - STRUCTURAL CONCRETE**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

- A. The General Conditions of the Contract, including General Requirements of Division 1 apply to the work specified in this Section.

#### **1.2 DESCRIPTION**

- A. The work under this Section includes all labor, materials, equipment and services necessary to complete the structural concrete work as shown on the drawings and herein specified.

#### **1.3 QUALITY ASSURANCE**

- A. Requirements of Regulatory Agencies: Perform work in accordance with local building codes and A.C.I. 318 latest edition.

- B. Reference Standards:

- 1. American Concrete Institute (A.C.I.) latest edition:
  - a. A.C.I. 301 - Specifications for Structural Concrete Buildings.
  - b. A.C.I. 305 - Recommended Practice for Hot Weather Concreting.
  - c. A.C.I. 318 - Building Code Requirements for Reinforced Concrete.
- 2. American Society for Testing and Materials (A.S.T.M.) latest edition:
  - a. A.S.T.M. C-33 - Concrete Aggregate.
  - b. A.S.T.M. C-94 - Ready-mix concrete.
  - c. A.S.T.M. C-143 - Test for Slump of Portland Cement Concrete.
  - d. A.S.T.M. C-150 - Portland Cement.
  - e. A.S.T.M. C-260 - Air-Entraining Admixtures for Concrete.
  - f. A.S.T.M. C-494 - Chemical Admixtures for Concrete.

- C. Source Quality Control: Testing and inspection as specified herein.
- D. Concrete Mix Design Criteria: Contractor shall be responsible for, and pay for design of concrete mixes. Design of concrete mixes shall be performed by a Testing Laboratory selected by Contractor and accepted by Architect.

#### 1.4 SUBMITTALS

- A. Comply with Section 01300 Submittals.
- B. Submittals: Submit 6 copies of design mixes for each class of concrete shall be submitted for review prior to pouring any concrete. The design mixes shall list all ingredients, admixtures, and slump. Submit designation where mix is specifically to be used, i.e., tie beam, slab, foundation, bond beam, filled cell etc.

### PART 2 - PRODUCTS

#### 2.1 MATERIALS

- A. Portland Cement: A.S.T.M. C-150 Type 1, Cement containing fly ash shall not be permitted.
- B. Aggregates: A.S.T.M. C-33, fine and coarse aggregates, free of chemicals, coatings, dirt, mud, organic material, or other deleterious matter affecting bonding of the cement paste.
  - 1. Coarse Aggregate Size: No larger than  $1/5$  the narrowest dimension between forms, nor  $3/4$  of clear space between reinforcing bars or bar and nearest face of form, nor  $1/3$  depth of concrete slabs on grade.
- C. Water: Use potable water.
- D. Water-Reducing Admixtures: A.S.T.M. C-494, Type A type to density of concrete but containing no calcium chloride.
- E. Curing Materials: A.S.T.M. C-309, method as selected to keep concrete moist during curing period. In case curing compounds are used in areas where waterproofing membrane is required, the compound must be type compatible with waterproofing membrane.
- F. Floor Hardener: For exposed concrete floor finishes, hardener shall be a silicious aggregate, Master Builder's "Mastercron", Devoe Paint Division of Celanese Coatings Company's "Hurundum" or approved equal.
- G. Vapor Barrier Under Slabs: Minimum 15 mil thick membrane.

## 2.2 MIXES

- A. Class of Concrete: Class "A" concrete shall have a compressive strength of not less than 3,000 p.s.i. typical and shall be used for reinforced concrete work, including all structural pedestals, slabs, footings & filled cells, 3,500 p.s.i. at second floor deck and 4,000 p.s.i. at columns and beams.
- B. Slump Test (Discharge): All pumped concrete with #57 aggregate is to contain a high range water reducing agent. Minimum size of discharge to be 4" I.D. A 2" I.D. discharge may be used with #8 aggregate. Use plasticizer admixture if necessary to increase slumps beyond that noted above.
- C. Ready-Mix Concrete: Concrete shall be transmit-mixed concrete batched, mixed and supplied in accordance with A.S.T.M. C-94.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Contractor shall coordinate the openings, slopes and depressions in concrete slabs as shown on drawings including setting of bolts, inserts, anchors, sleeves and other miscellaneous items as work progresses.

### 3.2 INSPECTIONS

- A. Notify Architect 48-hours in advance of any concrete placement. Place no concrete until forms and reinforcement have been inspected and approved by Architect.

### 3.3 INSTALLATION

- A. Placement: Concrete shall be conveyed and deposited in final position to avoid separation due to rehandling or flowing. Maximum height of concrete fall shall be 5'-0". Full vibration of mix shall be used to consolidate concrete in form and around reinforcing. The use of jitterbugs is not permitted. concrete shall not be placed at temperatures less than 40 degrees F.
- B. Joints: Construction joints with keys shall be located where shown on the drawings and where directed or approved by the Architect. Placing of concrete, once started, shall continue without interruption so that the placement will be monolithic. Not less than 72-hours shall elapse between casting of adjoining units, unless otherwise directed by Engineer.
- C. Finishing:
  - 1. Building Surface Finishes (Rubbed Finish): Within 48 hours after stripping forms, rub surfaces with a carborundum stone, clean water

and neat Portland Cement to provide a uniform, lightly sand-textured surface, entirely free of pits, etc.

2. Floor Finishes or Flatwork (Smooth Trowel Finish): Apply to concrete floors and slabs scheduled to receive finish floor covering (except exterior walls), and scheduled to remain exposed concrete. After concrete has set sufficiently to support weight, use mechanical floats for finish leveling.
  3. After water sheen has disappeared from surface, trowel with steel trowel to smooth surface free from blemishes and trowel marks. Perform final troweling after concrete is so hard that no mortar accumulates on trowel and a ringing sound is produced as trowels are drawn over the surface. Exterior walls shall match finish on sidewalks of complex.
- D. Curing: Concrete shall be cured in a manner to establish the full strength and to avoid premature drying. Concrete shall be kept wet with clean water for a period of 7 days after placing. Each day the forms are left in place shall suffice for wetting. Curing may be accomplished by leaving forms in place for a period of 7 days, and keeping those forms sufficiently wet to prevent opening of joints.

### 3.4 FIELD QUALITY CONTROL

- A. Testing: Tests shall be by a Materials Engineering Testing Firm, and retained and paid for by the County.
- B. Specimens shall be made and cured by the Testing Company as per A.S.T.M. C-31 and C-172. Three (3) specimens per test, not less than one test for each day's pour, each 50 yards of concrete poured, each building unit or each strength concrete or as directed by Architect. Specimens should be lab cured. Test cylinders shall be made by a representative of the testing company only and all materials, design, and field placement information recorded by him.
- C. Specimens shall be tested in accordance with A.S.T.M. C-39. One (1) specimen shall be tested at 7 days, one at 28 days, and one stored and broken as directed. Cylinders failing to meet required strength shall be stored for 3- days. Concrete which shows full design strength at 7 days test shall not have the 28 day test.
- D. Four (4) copies of test report at 7 and 28 days sent directly to the Architect by the testing laboratory shall contain placement and test dates, mix proportions, water/cement ratios, slump, location of batch, required and breaking strengths in psi and type of break.
- E. Placement Inspections: The laboratory concrete inspection shall verify

quality, consistency, and placement. They shall make all slump tests and prepare all molded cylinders for testing, and shall have authority to reject all workmanship and materials that are not in accordance with the specifications. Non-structural concrete need not be inspected.

- F. Core Tests: If the test results of the molded cylinder specimens fall below the required strength, core tests shall be taken where directed by the Architect. Core shall be taken in accordance with A.S.T.M. C-42, and tested as specified for molded specimens. If the results of compressive tests on core specimens fail to show the required strengths, the concrete will be deemed defective and shall be removed and replaced by the Contractor with new concrete that does meet the specified requirements, all at no additional cost to the Owner.

END SECTION 03300

## **SECTION 04220 - UNIT MASONRY WORK**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

- A. The General Provisions of the Contract, including General and Supplementary Conditions and General Requirements, apply to the work specified in this Section.

#### **1.2 DESCRIPTION OF WORK**

- A. The extent of each type of unit masonry work is shown on the drawings and in schedules.

#### **1.3 QUALITY ASSURANCE**

- A. Fire-Rated Masonry: Wherever a fire-resistance classification is shown or scheduled for unit masonry construction (1 & 2 hr.) and similar designations, comply with the requirements for materials and installation established by governing authorities and UL listing for the construction shown.
- B. Job Mock-Up: Prior to installation of masonry work, erect sample wall panel mock-up using materials, bond and joint tooling required for final work. Provide special features as directed for caulking and continuous work. Build mock-up at the site, where directed, of full thickness and approximately 4' x 4', indicating the proposed range of color, texture and workmanship to be expected in the completed work. Obtain Architect's acceptance of visual qualities of the mock-up before start of masonry work. Retain mock-up during construction as a standard for judging completed masonry work. Do not alter, move or destroy mock-up until work is completed. Use sample panels to test proposed cleaning procedures.
- C. Related Sections: Structural Concrete, Section 03300; Concrete Reinforcing, Section 03200.
- D. Standards: Masonry construction shall conform to A.C.I. Florida Building Code requirements for concrete masonry structures (A.C.I. 530 latest edition).
- E. Allowable Tolerances: Maximum variation from plumb in vertical lines and surfaces of columns, wall and arises is 1/4" in twelve (12) feet.
- F. Maximum variation from plan location of related portions of columns, walls and partitions is 1/4" in ten (10) feet.

- G. Maximum variation in cross-sectional dimensions of columns and thickness of walls from dimensions shown on drawings is plus or minus 1/4".
- H. Contractor shall be responsible for maintaining all cells free of excess mortar droppings including at horizontal reinforcing to allow free flow of concrete and loose fill insulation through cell.

#### 1.4 SUBMITTALS

- A. Manufacturer's Data, Unit Masonry: Submit 6 copies of manufacturer's specifications and other data for each type of masonry unit and accessory required including certification that each type complies with the specified requirements. Include instructions for handling, storage, installation and protection. Transmit a copy of each instruction to the Installer.
- B. Samples, Unit Masonry: Submit for approval of texture, duplicate samples of each size of block. One approved sample of each size shall be maintained at the site as a standard of texture and quality.

#### 1.5 JOB CONDITIONS

- A. Protection of Work: During erection, cover top of wall with heavy waterproof sheeting at end of each day's work. Cover partially completed structures when work is not in progress.
- B. Extend cover a minimum of 24" down both sides and hold cover securely in place.
- C. Do not apply uniform floor or roof loading for at least 12 hours after building masonry walls or columns.
- D. Do not apply concentrated loads for at least 3 days after building masonry walls or columns.
- E. Staining: Prevent grout or mortar from staining the face of masonry to be left exposed or painted. Remove immediately grout or mortar in contact with such masonry.
- F. Protect sills, ledges and projections from droppings of mortar.
- G. Cold Weather Protection: Remove all masonry determined to be frozen or damaged by freezing conditions. Perform the following construction procedures while the work is progressing:
  - 1. When air temperature is from 40 F. to 32 F., heat sand or mixing water to produce mortar temperatures between 40 F. and 120 F.



2. When air temperature is from 32 F. to 25 F., heat sand or water to produce mortar temperatures between 40 F. and 120 F.; maintain temperature of mortar on boards above freezing.
- H. Perform the following protection for completed masonry and masonry not being worked on:
1. When the mean daily air temperature is from 40 F. to 32 F., protect masonry from rain for at least 24 hours by covering the weather-resistant membrane.
  2. When mean daily air temperature is from 32 F. to 25 F., completely cover masonry with weather-resistant membrane for at least 24 hours.

## PART 2 - PRODUCTS

### 2.1 MASONRY UNITS - GENERAL

- A. Manufacturer: Obtain masonry units from one manufacturer, of uniform texture and color for each kind required, for each continuous area and visually related area.
- B. Size: Manufacturer's standard units with nominal face dimensions 8" x 8" x 16" long and half block, special shapes, scored units, and sizes shall be furnished as required.
- C. Special Shapes: Provide where required for lintels, corners, jambs, sash, control joints, headers, bond beam block, precast upset door lintels, bonding, sills, scored units and other special units.
- D. Hollow Load-Bearing Block: ASTM C-90, 28 day strength at 2000 psi ( $F_m = 1500$  psi).
- E. Split face block, select, scored, spf finish 8A05. Half corner 8A04, Half 8A03. The depth of split will be selected by the Architect for uniformity of wall. The selected depth for the split will then be constructed into the sample wall.
- F. Curing: Cure units in a moisture-controlled atmosphere or in an autoclave at normal pressure and temperature to comply with ASTM C-90 requirements.
- G. Exposed Face: Provide manufacturer's standard color and select texture, unless otherwise indicated.
- H. Color: Standard Gray; provide a single color for all masonry materials.

### 2.2 TYPE OF UNIT FINISH

- A. Standard masonry unit as shown on the building elevation drawings as specified here in.
- B. Split face masonry units as shown on the building elevation drawing with vertical 8" score and specified here in.

## 2.3 MORTAR MATERIALS

- A. Mortar shall be type "S": 1800 PSI in accordance with ASTM C270.
  - 1. Portland Cement: ASTM C-150, Type I.
  - 2. Masonry Cement: ASTM C-901.
  - 3. Hydrated Lime: ASTM C-207, Type S.
  - 4. Sand: ASTM C-144, except for joints less than 1/4", use aggregate graded with 100% passing the No. 16 sieve.
  - 5. Water: Clean drinkable, free of deleterious material.

## 2.4 MASONRY ACCESSORIES

- A. Continuous Wire Reinforcing and Ties for Masonry: Install continuous reinforcement at 16" o.c. vertically in CMU walls. Lap reinforcement 6" at ends.
- B. Provide welded wire units prefabricated in straight lengths of not less than 10 feet with matching corner and tee units. Fabricate from cold-drawn steel wire complying with ASTM A-82, with deformed continuous side rods and plain cross-rods, and a unit width of 1-1/2" to 2" less than thickness of wall or partition.
- C. Provide units fabricated as follows:
  - 1. Truss Type: Fabricated with single pair of 9-gauge side rods and 9-gauge continuous diagonal cross-rods spaced not more than 16" o.c. For exterior walls, hot dip galvanize after fabrication with 1.5 oz. zinc coating, ASTM A-153, Class B2.
- D. Anchors And Ties: Provide straps, bars, bolts and rods fabricated from not less than 16-gauge sheet metal or 1/2" diameter rod stock, 1/4" flat steel bar, unless otherwise indicated.
- E. Concrete Inserts for Masonry: For installation of concrete inserts, see concrete sections of these specifications. Advise Concrete Installer of specific requirements regarding his placement of inserts, which are to be

used by the Masonry Installer for anchoring of masonry work.

- F. Flashings for Masonry: Provide concealed flashings shown to be built into masonry. Provide concealed flashing as shown or noted on drawings.

## 2.5 MISCELLANEOUS MASONRY ACCESSORIES

- A. Reinforcing Bars: Deformed steel, ASTM A-615, Grade 60 of the sizes shown.
- B. Non-Metallic Expansion Joint Strips: Provide pre-molded, compressible, elastic fillers of foam rubber neoprene, or extruded plastic. Refer to Sections on Sealants.

## PART 3 - EXECUTION

### 3.1 INSPECTION

- A. The Masonry Installer must examine the areas and conditions under which masonry is to be installed and notify the Contractor in writing of conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to masonry Installer.

### 3.2 INSTALLATION - GENERAL

- A. Thickness: Build masonry construction to the full thickness shown, except, build single-wythe walls (if any) to the actual thickness of the masonry units, using units of nominal thickness shown or specified.
- B. Cut masonry units with motor driven saw designed to cut masonry with clean sharp, un-chipped edges. Cut units as required to provide pattern shown and to fit adjoining work neatly. Use full units without cutting wherever possible.
- C. Do not wet concrete masonry units.
- D. Frozen Materials and Work: Do not use frozen material or material mixed or coated with frost. For masonry, which is specified to be wetted, comply with the B.I.A. Recommendations. Do not build on frozen work. Remove and replace masonry work damaged by frost or freezing.
- E. Do not lower the freezing point of mortar by use of admixtures or antifreeze agents. Do not use calcium chloride in mortar or grout.
- F. Pattern Bond: Lay masonry in the bond pattern shown, or if not shown, lay in running bond, vertical joint in each course centered on units in courses above and below. Bond and interlock each course of each wythe at corners, unless

otherwise shown.

- G. Lay out walls in advance for accurate spacing of surface bond patterns, with uniform joint widths and to properly locate openings, movement-type joints, returns and offsets. Avoid the use of less-than-half-size units at corners, jambs, and wherever possible at other locations. Lay walls plumb and true and with courses level, accurately spaced and coordinated with other work.
- H. Stopping and Resuming Work: Rack back 1/2 masonry unit length in each course. Do not tooth. Clean exposed surfaces of set masonry, and remove loose masonry units and mortar prior to laying fresh masonry.
- I. Built-In Work: As the work progresses, build-in items specified under this and other sections of these specifications. Fill in solidly with masonry around build-in items. Fill space between hollow metal frames and masonry solidly with mortar. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath in the joint below and rod mortar or grout into core.

### 3.3 MORTAR BEDDING AND JOINTING

- A. Mortar Mixes: ASTM C-270, proportion specifications and the following types:
  - 1. Use Type S mortar for exterior above grade loadbearing and non-loadbearing walls, parapet walls, pavements. And for interior loadbearing walls and non-loadbearing partitions, mortar having an average compressive strength at 28 days of 1,800 psi.
- B. Batch Control: Measure and batch materials either by volume or weight, such that the required proportions for mortar can be accurately controlled and maintained. Measurement of sand exclusively by shovel will not be permitted.
- C. Mix mortars with the maximum amount of water consistent with workability to provide maximum tensile bond strength within the capacity of the mortar.
- D. Mix mortar ingredients for a minimum of 5 minutes in a mechanical batch mixer. Use water clean and free of deleterious materials, which would impair the work. Do not use mortar that has begun to set, or if more than 2-1/2 hours has elapsed since initial mixing.
- E. Retemper mortar during 1-1/2 hours' period as required to restore workability.
- F. Lay hollow concrete masonry units with full mortar coverage on horizontal and vertical face shells. Also, bed webs in mortar in starting course on footings and foundation walls and in all courses of piers, columns and

- pilasters, and where adjacent to cells or cavities to be reinforced or to be filled with concrete, grout, or loose fill insulation.
- G. Joints: Maintain joint widths shown, except for minor variations required to maintain bond alignment. If not otherwise indicated, lay walls with 3/8" joints. Cut joints flush for masonry walls, which are to be concealed or to be covered by other material. Tool exposed joints raked for the split face block and slightly concave for standard masonry. Rake out mortar in preparation for application of caulking or sealants where shown. Tuck Point all glazed block joints with epoxy grout.
- H. Exposed walls finish joints as follows: Vertical joints flush, horizontal joints raked to match existing building.
- I. Remove masonry units disturbed after laying. Clean and relay in fresh mortar. Do not pound corners at jambs to fit stretcher units, which have been set in position. If adjustments are required, remove units, clean off mortar, and reset in fresh mortar.

### 3.4 LINTELS

- A. General: Install lintels where shown. Provide poured in place lintels where shown wherever openings of more than 1'-0" are shown without structural steel or other supporting lintels. Temporarily support formed-in-place lintels.
- B. For hollow concrete masonry unit walls, shall be poured in place bars placed as shown on drawings and filled with concrete.
- C. Provide minimum bearing at each jamb, or 4" for openings less than 6'-0" wide, and 8" for wider openings.

### 3.5 CONTROL AND EXPANSION JOINTS

- A. General: Provide vertical expansion, control and isolation joints in masonry where shown. Build-in related masonry accessory items as the masonry work progresses. See Section 07900 for Sealants and Caulking.

### 3.6 REPAIR, POINTING AND CLEANING

- A. General: Remove and replace masonry units which are loose, chipped, broken, stained or otherwise damaged, or if units do not match adjoining units as intended. Provide new units to match adjoining units and install in fresh mortar or grout, pointed to eliminate evidence of replacement.
- B. Pointing: During the tooling of joints, enlarge any voids or holes, except weep holes, and completely fill with water. Point all joints at corners, opening and adjacent work to provide a neat, uniform appearance, properly prepared for

application of caulking or sealant compounds.

- C. Clean exposed CMU masonry by dry brushing at the end of each day's work and after final pointing to remove mortar spots and droppings.

### 3.7 SILL WEEP

- A. General: Install PVC weeps per drawing. Keep weeps clear and clean to allow for positive drainage of concrete sills to the exterior.

END SECTION 04220

## **SECTION 05120 - STRUCTURAL STEEL**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

- A. Drawings and General Provisions of Contract, including General and Supplementary Conditions and Division 1 apply to work specified in this Section.

#### **1.2 DESCRIPTION**

- A. Extent of structural steel work is shown on drawings, including schedules, notes and details to show size and location of members, typical connections and type of steel required.
- B. Structural steel is that work defined in A.I.S.C. "Code of Standard Practice" and as otherwise shown on the drawings.
- C. Miscellaneous metal fabrication is specified in section "Metal Fabrications".

#### **1.3 QUALITY ASSURANCE**

- A. Comply with provisions of the following codes and standards except as otherwise indicated:
  - 1. A.I.S.C. "Code of Standard Practice of Steel Buildings and Bridges".
  - 2. A.I.S.C. "Specifications for the Design, Fabrication and Erection of Structural Steel for Buildings", including the "Commentary" and supplements thereto issued.
  - 3. A.I.S.C. "Specifications for Architecturally Exposed Structural Steel".
  - 4. 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.
  - 5. A.W.S.D-1.1 "Structural Welding Code".

#### **1.4 QUALIFICATIONS FOR WELDING WORK**

- A. Qualify welding processes and welding operators in accordance with A.W.S. "Standard Qualification Procedure". Provide certifications that welders to be employed in work have satisfactorily passed A.W.S. qualification tests within previous months. If re-certification of welder is required, retesting will be

Contractor's responsibility.

## 1.5 SUBMITTALS

### A. Shop Drawings:

1. Submit shop drawings prepared under supervision of a registered professional Engineer in the State of Florida, including complete details and schedules for fabrication and assembly of structural steel members procedures and diagrams. (Do not photocopy Engineering drawings).
2. Include details of cuts, connections, cambers holes, and other pertinent data. Indicate welds by standard A.W.S. symbols, and show size, length, and type of each weld. Provide setting drawings, templates and directions for installation of anchor bolts and other anchorages to be installed by others.

## 1.6 DELIVERY, STORAGE AND HANDLING

- A. Deliver anchor bolts and anchorage devices, which are to be embedded in cast-in-place concrete or masonry, in ample time to not delay that work.
- B. Store material to permit easy access for inspection and identification. Keep steel members off the ground, using pallets, platforms, or other supports. Protect steel members and packaged materials from erosion and deterioration.
- C. Do not store material on structure in a manner that might cause distortion or damage to members or supporting structures. Repair or replace damaged materials or structures as directed.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. Metal Surfaces (General): For fabrication of work which will be exposed to view, use only materials which are smooth and free of surface blemishes including pitting, seam marks, roller marks, rolled trade names and roughness. Remove such blemishes by grinding, or by welding and grinding, prior to cleaning treating and application of surface finishes.
- B. Structural Steel Shapes, Wide Flange: ASTM A-992, except where other type steel is indicated.
- C. Structural Steel Plates, Angles, and Bars: ASTM A-36



- D. Steel Pipe: A-500. Black finish except where indicated to be galvanized.
- E. Anchor Bolts: A-325, Grade A, non-headed type, unless otherwise indicated.
- F. Unfinished Threaded Fasteners: A-307, Grade A, regular low-carbon steel bolts and nuts.
  - 1. Provide hexagonal heads and nuts for all connections.
  - 2. Provide either hexagonal or square heads and nuts except use only hexagonal units for exposed connections.
- F. High-Strength Threaded Fasteners: Heavy hexagon structural bolts, heavy hexagon nuts, and hardened washers, as follows:
  - 1. Quenched and tempered medium-carbon steel bolts, nuts and washers, complying with A.S.T.M. A-325.
- G. Electrodes for Welding: Comply with A.W.S. Code and the following:
  - 1. Shield Metal-Arc Welding A.W.S. 5.1.
  - 2. Submerged-Arc Welding A.W.S. A-5.17.
  - 3. Gas Metal-Arc Welding A.W.S. A-5.18.
- H. Structural Steel Primer Paint: Fabricator's standard rust-inhibiting primer.
- I. Metallic Shrinkage-Resistant Grout: Corps. of Engineers C.R.D.C.-588, Type M. pre-mixed factory-packaged ferrous aggregate grouting compound, as manufactured by one of the following:
  - 1. Embeco 1253; Master Buildings; Ferrolit G; Sonneborn/Contech; KemoxC; Sika Chemical.
- J. Galvanized Members: Hot-dip galvanized (ASTM B-6) with a zinc coating of 1.8 ounces/square foot as per ASTM G-90.

## 2.2 FABRICATION

- A. Shop Fabrication and Assembly: Fabricate and assemble structural assemblies in shop to greatest extent possible. Fabricate items of structural steel in accordance with A.I.S.C. Specifications and as indicated in final shop drawings. Provide camber in structural members where indicated. Properly mark and match-mark materials for field assembly. Fabricate for delivery sequence which will expedite erection and minimize field handling of materials. Where finishing is required, complete assembly including welding

of units, before start of finishing operation. Provide finish surfaces of members exposed in final structures free of markings.

- B. Connections: Weld or bolt shop connections as indicated. Bolt field connections except where welded connections or other connections are indicated. Provide high-strength threaded fasteners for principal bolted connections, except where unfinished bolts are indicated.
- C. High-Strength Bolted Connections: Install high-strength threaded fasteners in accordance with A.I.S.C. "Specifications for Structural Joints Using A.S.T.M. A-325 or A-490 Bolts" (R.C.R.B.S.J.). All high-strength bolted connections shall be bearing connections.
- D. Welded Connections: Comply with A.S.S. Code for procedures, appearance and quality of welds, and methods used in correcting welding work. Assemble and weld built-up sections by methods which will produce true alignment of axes without warp.

E. SHOP PAINTING:

1. General:

Shop paint structural steel, except galvanized steel and those members or portions of members to be embedded in concrete or mortar. Paint embedded steel that is partially exposed or exposed portions and initial 2" of embedded areas only. Do not paint surfaces which are to be welded or high-strength bolted with bearing-type connections.

2. Surface preparation:

After inspection and before shipping, clean steelwork to be painted. Remove loose rust, loose mill scale, and spatter, slag or flux deposits. Clean steel in accordance with Steel Structures Painting Council (S.S.P.C.), S.P.-2 "Hand Tool Cleaning".

3. Painting:

Immediately after surface preparation, apply structural steel primer paint in accordance with manufacturer's instructions and at a rate to provide a uniform dry film thickness of 1.5 mils. Use painting methods which result in full coverage of joints, corners, edges, and exposed surfaces.

PART 3 - EXECUTION

### 3.1 INSPECTION

- A. Erector must examine areas and conditions under which structural steel work is to be installed, and notify Contractor in writing of conditions detrimental to proper and timely completion of work. Do not proceed with work until unsatisfactory conditions have been corrected in a manner acceptable to the erector.

### 3.2 ERECTION

- A. Temporary Shoring and Backing: Provide temporary shoring and bracing members with connections of sufficient strength to bear imposed loads. Remove temporary members and connections when permanent members are in place and final connections are made. Provide temporary guy lines to achieve proper alignment of structures as erected proceeds.
- B. Temporary Planking: Provide temporary planking and working platforms as necessary to effectively complete work.
- C. Anchor Bolts: Furnish anchor bolts and other connections required for securing structural steel to foundations and other in-place work. Furnish templates and other devices as necessary for pre-setting bolts and other anchors to accurate locations. Refer to Division 3 of these specifications for anchor bolt installation requirements in concrete.
- D. Setting Bases and Bearing Plates:
  - 1. Clean concrete bearing surfaces of bond-reducing materials and roughen to improve bond to surfaces. Clean bottom surface of base and bearing plates.
  - 2. Tighten anchor bolts after supported members have been positioned and plumbed. Do not remove wedges or shims but in protruding, cut off flush with edge of base or bearing plate prior to packing with grout.
  - 3. Pack grout solidly between bearing surfaces and bases or plates to ensure that no voids remain. Finish exposed surfaces, protect installed materials and allow to cure. For proprietary, grout materials, comply with manufacturer's instructions.
- E. Field Assembly: Set structural frames accurately to lines and elevations indicated. Align and adjust various members forming a part of a complete frame or structure before permanently fastening. Clean bearing surfaces and other surfaces which will be in permanent contact before assembly. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.

F. Level and plumb individual members of structure within specified A.I.S.C. tolerances.

1. Establish required leveling and plumbing measurements on mean operating temperature of structure. make allowances for differences between temperature at time of erection and mean temperature at which structure will be when completed and in service.
2. Splice members only where indicated and accepted on shop drawings.

G. Erection Bolts:

1. On exposed welded construction, remove erection bolts, fill holes with plug welds and grind smooth at exposed surfaces.
2. Comply with A.I.S.C. Specifications for bearing, adequacy of temporary connections, alignment, and removal of paint on surfaces adjacent to field welds.
3. Do not enlarge unfair holes in members by burning or by use of drift pins, except in secondary bracing members. Ream holes that must be enlarged to admit bolts.

H. Gas Cutting:

1. Do not use gas cutting torches in field for correcting fabrication errors in structural framing. Cutting will be permitted only on secondary members which are not under stress, as acceptable to Architect. Finish gas-cut sections equal to a sheared appearance when permitted.

I. Touch-up Painting:

1. Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint. Apply paint to exposed areas with same material as used for shop painting.
2. Apply by brush or spray to provide a minimum dry film thickness of 2.0 mils.

J. Field Quality Control:

1. Engage an independent testing and inspection agency to inspect each high-strength bolted connections and welded connections and to perform test reports.
2. Testing agency shall conduct and interpret tests and state in each

report whether test specimens comply with requirements and specifically state any deviations therefrom.

3. Provide access for testing agency to places where structural steel work is being fabricated or produced so that required inspection and testing can be accomplished.
4. Testing agency may inspect structural steel at plant before shipment; however, Architect reserves right at any time before final acceptance, to reject material and complying with specified requirements.
5. Correct deficiencies in structural steel work which inspection and laboratory test reports have indicated to be not in compliance with requirements. Perform additional tests, at contractor's expense, as may be necessary to reconfirm any non-compliance of corrected work.

K. Shop Bolted Connections: Inspect in accordance with A.I.S.C. specifications.

L. Shop Welding:

1. Inspect and test during fabrication of structural steel assemblies.
2. Certify welders and conduct inspections and tests are required. Record types and locations of defects found in work. Record work required and performed to correct deficiencies.
3. Perform visual inspection on all welds.

M. Perform Tests Of Welds As Follows:

1. Inspection procedures listed are to be used at Contractor's option.
  - a) Liquid Penetrant Inspection: A.S.T.M. E-165.
  - b) Magnetic Particle Inspection: A.S.T.M. E-109; performed on root pass and on finished weld. Cracks and zones of incomplete fusion or penetration not acceptable.

N. Field Test Of Field Welding:

1. The owner's testing lab will conduct visual inspection on all welds. The general contractor will coordinate with Orange County Project Manager for scheduling of all field inspections.

END SECTION 05120

## **SECTION 05220 - STEEL JOISTS**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

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

#### **1.2 SUMMARY**

- A. This Section includes steel joists for floor and roof framing. Types of joists required include the following:
  - 1. K-Series Open Web Steel Joists.
  - 2. Longspan Series Steel Joists.
- B. Refer to Division 3 Sections for installation of anchors set in concrete.
- C. Refer to Division 4 Sections for installation of anchors set in masonry.
- D. Refer to Section 05120 for structural steel bearing angles or plates and bridging attachments to structure.
- E. Refer to Section 05120 for inspection of joist connections.

#### **1.3 SUBMITTALS**

- A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.
- B. Product data and installation instructions for each type of joist and accessories. Include manufacturer's certification that joists comply with SJI "Specifications."
- C. Shop drawings showing layout of joist members, special connections, joining and accessories. Include mark, number, type, location and spacing of joists and bridging.
  - 1. Provide templates or location drawings for installation of anchor bolts and metal bearing plates.
- D. Design Calculations: Provide design calculations signed and sealed by a Florida registered engineer to verify design for uplift and special joists.

#### 1.4 QUALITY ASSURANCE

- A. General: Provide joists fabricated in compliance with Steel Joist Institute (SJI) "Standard Specifications, Load Tables and Weight Tables for Steel Joists and Joist Girders."
- B. Qualification of Field Welding: Qualify welding processes and welding operators in accordance with American Welding Society (AWS) "Structural Welding Code - Steel," AWS D1.1.
- C. Inspection: Inspect joists in accordance with SJI "Specifications."

#### 1.5 DELIVERY, STORAGE AND HANDLING

- A. Deliver, store and handle steel joists as recommended in SJI "Specifications." Handle and store joists in a manner to avoid deforming members and to avoid excessive stresses.

### PART 2 - PRODUCTS

#### 2.1 MATERIALS

- A. Steel: Comply with SJI "Specifications" for chord and web sections.
- B. Steel Bearing Plates: ASTM A-36.
- C. Unfinished Threaded Fasteners: ASTM A-307, Grade A, regular hexagon type, low carbon steel.
- D. Steel Prime Paint: Manufacturer's standard.

#### 2.2 FABRICATION

- A. General: Fabricate steel joists in accordance with SJI "Specification."
- B. Holes in Chord Members: Provide holes in chord members where shown for securing other work to steel joists; however, deduct area of holes from the area of chord when calculating strength of member.
- C. Extended End: Provide extended ends on joists where indicated, complying with SJI "Specifications" and load tables.
- D. Ceiling Extension: Provide ceiling extensions in areas having ceilings attached directly to joist bottom chord. Provide either an extended bottom chord element or a separate unit, to suit manufacturer's standards, of sufficient strength to support ceiling construction. Extend ends to within 1/2 inch of finished wall surface, unless otherwise indicated.

- E. Top Chord Extension: Provide top chord extensions ("S" type) on joists where indicated, complying with SJI "Specifications" and load tables.
- F. Bridging: Provide horizontal or diagonal type bridging for joists, complying with SJI "Specifications" and as shown on project drawings.
- G. Header Units: Provide header units to support tail joists at openings in floor or roof system not framed with steel shapes.
- H. Shop Painting: Remove loose scale, heavy rust, and other foreign materials from fabricated joists and accessories before application of shop paint.
  - 1. Apply one shop coat of steel prime paint to joists and accessories, by spraying, dipping, or other method to provide a continuous dry paint film thickness or not less than 0.50 mil.
  - 2. Do not paint surfaces scheduled to receive sprayed-on fireproofing.

## PART 3 - EXECUTION

### 3.1 ERECTION

- A. Place and secure steel joists in accordance with SJI "Specifications," final shop drawings, and as herein specified.
- B. Anchors: Furnish anchor bolts, steel bearing plates, and other devices to be built into concrete and masonry construction.
  - 1. Provide unfinished threaded fasteners for anchor bolts, unless high strength bolts indicated.
- C. Placing Joists: Do not start placement of steel joists until supporting work is in place and secured. Place joists on supporting work, adjust and align in accurate locations and spacing before permanently fastening.
- D. Provide temporary bridging, connections and anchors to ensure lateral stability during construction.
  - 1. Where "open-web" joist lengths are 40 feet and longer, install a center row of bolted bridging to provide lateral stability before slackening of hoisting lines.



- E. Bridging: Install bridging simultaneously with joist erection, before construction loads are applied. Anchor ends of bridging lines at top and bottom chords where terminating at walls or beams.
- F. Fastening Joists: Comply with the following:
1. Field weld joists to supporting steel framework and steel bearing plates where indicated in accordance with SJI "Specifications" for type of joists used. Coordinate welding sequence and procedure with placing of joists.
  2. Bolt joists to supporting steel framework in accordance with SJI "Specifications" for type of joists used.
    - a) Use unfinished threaded fasteners for bolted connections, unless otherwise indicated.
- G. Inspection: Joist end connections and bridging connections are to be inspected per AISC requirements and as noted in Section 05120.
- H. Touch-up Painting: After joist installation, wire brush welded areas, abraded or rusty surfaces, and clean with solvent. Paint field-applied bolt heads and nuts and prepared surfaces on joists and steel supporting members. Use same type of paint as used for shop painting.

END SECTION 05220

## **SECTION 05300 - METAL DECKING**

### **PART 1 – GENERAL**

#### **1.1 RELATED DOCUMENTS**

- A. Drawings and General Provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification sections apply to work specified in this section.

#### **1.2 DESCRIPTION OF WORK**

- A. Scope: Roof Decking. See structural drawings for additional requirements. The structural drawings and notes shall govern if there are any conflict with these specifications.

#### **1.3 QUALITY ASSURANCE**

- A. Codes and Standard: Comply with provisions of the following codes and standards, except as otherwise shown or specified:

1. AISI: "Specification for the Design of Cold-Formed Steel Structural Members".
2. AWS: "Structural Welding Code".
3. SDI: "Design Manual for Floor Decks and Roof Decks".

- B. Qualification of Field Welding: Quality welding process and welding operators in accordance with AWS "Standard Qualification Procedure".

1. Welded decking in place is subject to inspection and testing. Expense of removing and replacing portions of decking for testing purposes will be borne by Owner if welds are found to be satisfactory. Remove work found to be defective and replace with new acceptance work.

#### **1.4 SUBMITTALS**

- A. Product Data: Submit manufacturer's specifications and installation instructions for each type of decking and accessories. Include

manufacturer's certification as may be required to show compliance with these specifications.

- B. Shop Drawings: Submit detailed drawings showing layout and types of deck panels, anchorage details, and conditions requiring closure panels, supplementary framing, sump pans, cant strips, cut openings, special jointing or other accessories. Original construction documents shall not be duplicated for use as shop drawing submittals.

## PART 2 - PRODUCTS

### 2.0 MATERIALS

#### 2.1 Steel for Galvanized Metal Deck Units: ASTM A-446, Grade A

- A. Miscellaneous Steel Shapes: ASTM A-36.
- B. Sheet Metal Accessories: ASTM A-526, commercial quality, galvanized.
- C. Galvanizing Repair Paint: High zinc-dust content paint for repair of damaged galvanized surfaces complying with Military Specifications MIL-P-21035 (Ships).
- D. Flexible Closure Strips: Manufacturer's standard vulcanized, closed-cell, synthetic rubber.
- E. General: Form deck units in lengths to span 3 or more supports, with flush, telescoped or nested 2" laps at ends and interlocking or nested side laps, unless otherwise indicated.
- F. Roof Deck Units: Provide deck configurations complying with SDA "Roof Deck Specifications", of metal thickness, depth and width as shown. Decking shall be equal to Wheeling "Type B", galvanized or accepted.

## PART 3 - EXECUTION

### 3.13.1 INSPECTION

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

### 3.2 INSTALLATION

A. General: Install deck units and accessories in accordance with manufacturer's recommendations and final shop drawings, and as specified herein.

1. Place deck units on supporting steel framework and adjust to final position with ends accurately aligned and bearing on supporting members before being permanently fastened. Do not stretch or contract side lap interlocks.
2. Place deck units in straight alignment for entire length of run of cells and with close alignment between cells at ends of abutting units.
3. Place deck units flat and square, secured to adjacent framing without warp or excessive deflection.
4. Coordinate and cooperate with structural steel erector in locating decking bundles to prevent overloading of structural members.

#### B. Fastening Deck Units

1. Fasten roof deck units to steel supporting members by not less than 3/4" diameter fusion welds or elongated welds of equal strength, spaced not more than 6" o.c. at supports, and at closer spacing where required for lateral force resistance or where indicated.
2. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used in correcting welding work.
3. Use welding washers where recommended by deck manufacturer.
4. Lock side laps of adjacent deck units between supports, at intervals not exceeding 24" o.c.

C. Cutting and Fitting: Cut and neatly fit deck units and accessories around other work projecting thorough or adjacent to the decking, as shown.

D. Reinforcement and Openings: Provide additional metal reinforcement and closure pieces as required for strength, continuity of decking and support of other work shown.

E. Hanger Slots or Clips: Provide UL approved punched hanger slots between flutes of lower element where floor deck units are to receive hangers for

support of ceiling construction, air ducts, diffusers, or lighting fixtures.

1. Hanger clips designed to clip over male side lap joints of floor deck units may be used instead of hanger slots.
2. Locate slots or clips at not more than 14" o.c. in both directions, not over 9" from walls at ends, and not more than 12" from walls at sides, unless otherwise shown.
3. Provide manufacturer's standard hanger attachment devices.

F. Joint Covers: Provide metal joint covers at abutting ends and changes in direction of floor deck units.

G. Touch-Up Painting: Cleaning and touch-up painting of field welds, abraded areas and rust spots, as required after erection.

### 3.3 Field Inspection of Welding:

A. The owner's testing lab will conduct visual inspection on all welds. The general contractor will coordinate with Orange County Project Manager for scheduling of all field inspections.

END SECTION 05300

## **SECTION 05500 - METAL FABRICATIONS**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

- A. The General Conditions of the Contract, including the General Requirements of Division 1 apply to the work of this Section.

#### **1.2 DESCRIPTION**

- A. Work under this Section includes all labor and materials of metal fabrications as contained herein and shown on the drawings.

#### **1.3 QUALITY ASSURANCE**

- A. All work shall be designed, fabricated and erected by skilled workmen, thoroughly trained and experienced in the necessary crafts. Steel work shall comply with the "Specifications for the Design, Fabrication and Erection of Structural Steel for Buildings", by A.I.S.C.

#### **1.4 SHOP DRAWINGS**

- A. Submit 6 copies of shop drawings indicating necessary information for fabrication, erection and painting as per A.I.S.C. Specifications.

### **PART 2 - PRODUCTS**

#### **2.1 MATERIAL STANDARDS**

- A. Steel Plates, Shaped Bars: A.S.T.M. A-36.
- B. Steel Tubing, Hot-Formed, Welded or Seamless: A.S.T.M. A-500, Grade "B".
- C. Steel Bars: A.S.T.M. A-306, Grade 65 or A.S.T.M. A-36.
- D. Steel Sheets:
  - 1. Cold-Rolled Carbon: A.S.T.M. A-336
  - 2. Hot-Rolled: A.S.T.M. A-569, commercial quality.
  - 3. Galvanized Carbon: A.S.T.M. A-526, A.S.T.M. A-525, Grade 90.
- E. Malleable Iron Casting: A.S.T.M. A-47.

- F. Gray Iron Casting: A.S.T.M. A-48, Class 30.
- G. Steel Pipe: A.S.T.M. A-53, type or selected Grade "A" standard weight, Schedule 40 unless otherwise indicated.
- H. Non-Shrink, Non-Ferrous Grout: C.E., C.R.D., C-588.
- I. Bolts and Nuts: Regular hexagon-head type, A.S.T.M. A-325 Grade "n".
- J. Lag Bolts: Square-head type F.S., FF-B-561.
- K. Machine Screws: Cadmium plated steel, F.S., FF-S-92.
- L. Wood Screws: Flat-head carbon steel, F.S., FF-S-11.
- M. Masonry Anchors: Expansion shields, F.S., FF-S-325.
- N. Toggle Bolts: F.S., TT-B-588.
- O. Plain Washers: F.S., FF-W-92, round assembly grade carbon steel.
- P. Lock Washers: F.S., FF-W-84, helical spring type carbon steel.
- Q. Galvanized Steel: High quality practice for hot dip galvanizing: as per ASTM A-385 (minimum of 1.25 ounces of zinc per sq. ft.)
- R. Assembled Steel Products: Hot Dip Galvanizing as per ASTM A-386.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Furnish setting drawings, diagrams, templates, instruction and directions for installation of anchorages, such as concrete inserts, anchor bolts and miscellaneous items having integral anchors, which are to be embedded in concrete construction. Coordinate delivery of such items to project site.

### 3.2 FABRICATION

- A. Prior to fabrication, verify all measurements in field. All work shall be performed by skilled, experienced and qualified workmen equal to best practice in modern metal shops. All shop connections shall be welded. All steel and iron work to receive one shop coat of specified paint.

### 3.3 ERECTION

- A. Erect all fabrications plumb and level and to accurate elevations.
- B. Do all necessary temporary bracing required. Take particular care to have all work plumb and leveled before permanent connections are made.

#### 3.4 SETTING LOOSE PLATES

- A. Clean bearing surfaces free from bond-reducing materials, and roughen to improve bond to surface. Clean the bottom surface of bearing plates. Set loose leveling and bearing plates plumb and true.

#### 3.5 FASTENING TO IN-PLACE CONSTRUCTION

- A. Provide anchorage devices and fasteners where necessary for securing miscellaneous metal fabrications to in-place construction including threaded fasteners for concrete inserts, toggle bolts, wood screws, and other connectors as required.

#### 3.6 FIELD WELDING

- A. All welding shall be done by skilled, experienced, qualified and certified operators in accordance with A.W.S. (American Welding Society).

#### 3.7 FIELD PAINTING

- A. After erection, touch-up shop coat on all steel. Surface inaccessible after erection to receive second coat before erection.

END SECTION 05500



## **SECTION 06100 - ROUGH CARPENTRY**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

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

#### **1.2 DESCRIPTION OF WORK**

- A. Definition: Rough carpentry includes carpentry work not specified as part of other sections and which is generally not exposed, except as otherwise indicated. Types of work in this Section include rough carpentry for:

1. Wood framing.
2. Wood grounds, nailers, blocking and sleepers.
3. Wood furring.
4. Sheathing.

#### **1.3 SUBMITTALS**

- A. Material Certificates: Provide 6 copies of material certificates. Where dimensional lumber is provided to comply with minimum allowable unit stresses, submit listing of species and grade selected for each use, and submit evidence of compliance with specified requirements. Compliance may be in form signed copy of applicable portion of lumber producer's grading rules showing design values for selected specie and grade. Design values shall be as approved by the "Board of Review of American Lumber Standards Committee".
- B. Wood Treatment Data: Submit treatment manufacturers instructions for proper use of each type of treated material.
- C. Pressure Treatment: For each type specified, include certification by treating plant stating chemicals and process used, net amount of preservative retained and conformance with applicable standards.
- D. For water-borne preservatives, include statement that moisture content of treated materials was reduced to a maximum of 15% prior to shipment to project site.

#### 1.4 PRODUCT HANDLING

- A. Delivery and Storage: Keep materials dry at all times. Protect against exposure to weather and contact with damp or wet surfaces. Stack lumber and plywood, and provide air circulation within stacks.

#### 1.5 JOB CONDITIONS

- A. Coordination: Fit carpentry work to other work; scribe and cope as required for accurate fit. Correlate location of furring, nailers, blocking, grounds and similar supports to allow proper attachment of other work.

### PART 2 - PRODUCTS

#### 2.1 WOOD PRODUCT QUALITY STANDARDS

- A. Factory mark each piece of lumber and plywood with type, grade, mill and grading agency, except omit marking from surfaces to be exposed with transparent finish or without finish.

1. Lumber Standards: Comply with P.S.-20.
2. Plywood Standards: Comply with P.S.-1.

- B. Factory mark each piece of lumber and plywood with type, grade, mill and grading agency, except omit marking from surfaces to be exposed with transparent finish or without finish.

#### 2.2 MATERIALS

- A. Lumber, General: Nominal sizes are indicated, except as shown by detail dimensions. Provide actual sizes as required by P.S.-20, for moisture content specified for each use.

1. Note: Actual size of "green" lumber is different than "moisture-controlled" lumber sizes under P.S.-20.
2. Provide dressed lumber, S-4S, unless otherwise indicated.
3. Provide seasoned lumber with 19% maximum moisture content at time of dressing.

- B. For light framing, less than 6" wide, provide the following grade and species:

1. Standard grade, any species.

- C. For structural framing, 6" and wider and from 2" to 4" thick, provide the

following grade and species:

1. Southern Yellow Pine No 2
  2. Fb (minimum extreme fiber stress in bedding); 1400 psi.
  3. E (minimum modulus of elasticity); 1,600,000.
- D. Concealed Boards: Where boards will be concealed by other work, provide lumber of 19% maximum moisture content (S-DRY) and of following species and grade:
- E. Miscellaneous Lumber: Provide wood for support or attachment of other work including cant strips, bucks, nails, blocking, furring, grounds, stripping and similar members. Provide lumber of sizes shown or specified, worked into shapes shown, and as follows:
1. Moisture Content: 19% maximum for lumber items not specified to receive wood preservative treatment.
  2. Grade: Construction grade light framing size lumber of any species or board size lumber as required. Provide construction grade boards (R.I.S. or W.C.L.B.) or No. 2 boards (S.P.I.B. or W.W.P.A.)
- F. Plywood:
1. Concealed Plywood: Where plywood will be concealed by other work, provide C.D. Plugged/Ext.
  2. For plywood roof sheathing, provide with exterior glue.
  3. For backing panels, electrical or telephone equipment, provide fire-retardant treated plywood with exterior glue.
- G. Miscellaneous Materials:
1. Fasteners and Anchorages: Provide size, type, material and finish as indicated and as recommended by applicable standards, complying with the Florida Building Code, complying with applicable Federal Specifications for nails, screws, bolts, nuts, washers and anchoring devices. Provide metal hangers and framing anchors of the size and type recommended by the manufacturer for each use including recommending nails.
  2. Where rough carpentry work is exposed to weather, in ground contact, or in an area of high relative humidity, provide fasteners and anchorages with a hot-dip, zinc coating (A.S.T.M. A-153).

3. Building Paper: Asphalt saturated felt, non-perforated, A.S.T.M. D-226.

## 2.3 WOOD TREATMENT

A. Preservative Treatment: Where lumber or plywood is indicated as treated, or is specified herein to be treated, comply with applicable requirements of A.W.P.A. Standards C-2 lumber and C-9 plywood and of A.W.P.A. standards listed below. Mark each treated item with the A.W.P.A. Quality Mark Requirements.

1. Pressure-treat above ground items with water-borne preservatives complying with A.W.P.A. P5-01, P5-02. After treatment, kiln-dry to a maximum moisture content of 15%. Treat indicated items and the following:
  - a. Wood cants, nailers, curbs, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers and waterproofing.
  - b. Wood sills, sleepers, blocking, furring, stripping, and similar concealed members in contact with masonry or concrete.
  - c. Wood framing members less than 18" above grade.
  - d. Complete fabrication of treated items prior to treatment, where possible. If cut after treatment, coat cut surfaces with heavy brush coat of same chemical used for treatment. Inspect each piece of lumber or plywood after drying and discard damaged or defective pieces.
2. Fire-Retardant Treatment: Where lumber or plywood is specified or otherwise indicated, provide materials which comply with A.W.P.A. Standards for pressure impregnation with fire-retardant chemicals, and which have a flame spread rating of not more than 25 when tested in accordance with UL Test 723 or A.S.T.M. E-84, and show no increase in flame spread and significant progressive combustion upon continuation of test for additional 20 minutes.
3. Use fire-retardant treatment which will not bleed through or adversely affect type of finish indicated and which does not require brush treatment of field made end cuts to maintain fire-hazard classification. Kiln-dry treated items to maximum moisture content of 19%.
4. Provide UL label on each piece of fire-retardant lumber or plywood.

5. Inspect each piece of treated lumber or plywood after drying and discard damaged or defective pieces.

### PART 3 - EXECUTION:

#### 3.1 INSTALLATION

- A. General: Discard units of material impair quality of work, and units which are too small to fabricate work with minimum joints or optimum joint arrangement.
  1. Set carpentry work accurately to required levels and lines with members plumb and true and accurately cut and fitted.
  2. Securely attach carpentry work to substrate by anchoring and fastening as shown and as required by recognized standards. Countersink nail heads on exposed carpentry work and fill holes.
  3. Use common wire nails except as otherwise indicated. Use finishing nails for finish work. Select fasteners of size that will not penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting of wood; predrill as required.
  4. Wood Grounds, Nailers, Blocking and Sleepers:
  5. Provide wherever 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. Coordinate location with other work involved.
  6. Attach to substrates as required to support applied loading. Countersink bolts and nuts flush with surfaces, unless otherwise shown. Build into masonry during installation of masonry work. Where possible, anchor to formwork before concrete placement.
  7. Provide permanent grounds of dressed, preservative treated, key-bevelled lumber not less than 1-1/2" wide and of thickness required to bring face of ground to exact thickness of finish material involved. Remove temporary grounds when no longer required.
- B. Wood Furring: Install plumb and level with closure strips at edges and openings. shim with wood as required for tolerance of finished work.
- C. Firestop furred spaces on walls at each floor level, with wood blocking or incombustible materials, accurately fitted to close furred spaces.

### 3.2 WOOD FRAMING

- A. General: Provide framing members of sizes and on spacing shown, and frame openings as shown or if not shown, comply with recommendations of "Manual for House Framing" and other recommendations of the N.F.P.A. Firestop concealed spaces with wood blocking not less than 2" thick if not blocked by other framing members. Provide blocking at each building story level and at ends of joist spans.

### 3.3 JOIST FRAMING

- A. General: Provide framing of sizes and spacings shown. Install with crown edge up and support ends of each member with not less than 3-1/2" of bearing on wood or metal, or 7-1/2" on masonry. Attach to wood bearing members by toe nailing or metal connectors; frame to wood supporting members with wood ledges as shown, or if not shown, with metal connectors. Fire-cut members built into masonry (if any). Frame openings with headers and trimmers supported by metal joist hangers; double headers and trimmers where span of header exceeds 4'-0". Do not notch in middle third of joists; limit notches to 1/6-depth of joist, 1/3 at ends. Do not bore holes larger than 1/3-depth of joist or locate closer than 2" from top or bottom. Provide solid blocking (2" thick by depth of joist) at ends of joists unless nailed to header or band members.
- B. Lap members framing from opposite sides of beams, girders or partitions not less than 4" or securely tie opposing members together. Provide solid blocking (2" thick by depth of joist) over supports.
- C. Provide bridging between joists where nominal depth-to-thickness ratio exceeds 4'-0" at intervals of 8'-0". Use bevel cut 1" x 4" or 2" x 3" wood bracing, double-crossed and nailed both ends to joists, or use solid wood bridging 2" thick by depth of joist, end nailed to joist.

### 3.4 RAFTER AND CEILING JOIST FRAMING

- A. Ceiling Joists: Provide member size and spacing shown, and as previously specified for joist framing. Face nail to ends of parallel rafters.
- B. Rafters: Provide member size and spacing shown. notch to fit exterior wall plates and toe nail or use special metal framing anchors. Double rafters to form headers and trimmers at openings in roof framing (if any), and support with metal hangers. Where rafters abut at ridge, place directly opposite each other and nail to ridge members. At valleys, provide valley rafter of size shown, or if not shown, provide rafter twice as thick as regular rafters and 2" deeper. Bevel ends of jack rafters for full bearing against hip rafters.
- C. Provide special framing as shown for eaves, overhangs, dormers and similar

conditions if any.

### 3.5 TIMBER FRAMING

- A. Provide wood beams and girders of the size and spacing shown. Install with crown edge up and provide not less than 4" bearing on supports. Provide continuous members unless shown; tie together over supports if not continuous.
- B. Where built-up beams or girders of nominal 2" dimension lumber on edge are shown, fasten together with 2 rows of 20-d nails spaced not more than 32" o.c. Locate one row near top edge and near other bottom edge. Locate end joints in members over supports; for continuous members, stagger ends at quarter points between supports.

### 3.6 INSTALLATION OF PLYWOOD

- A. Comply with recommendations of the "American Plywood Association" for the installation of plywood. Do not use staples gun attachment. Sheathing and Sub-flooring: Install in compliance with the Florida Building Code and as noted on the structural drawings. Provide thickness shown, or if not shown, provide thickness recommended by A.P.A.

END SECTION 06100

## **SECTION 06410 - ARCHITECTURAL WOODWORK**

### **PART 1- GENERAL**

#### **1.1 RELATED DOCUMENTS**

- A. The General Provision of the Contract, including General and Supplementary conditions and General Requirements, apply to the work specified in this Section.

#### **1.2 DESCRIPTION OF WORK**

- A. The extent of each type of architectural woodwork is shown on drawings and in schedules.
- B. Architectural woodwork is defined to include (in addition to items so designated on drawings) miscellaneous exposed wood members commonly known as "Finish Carpentry" or Millwork", except where specified under another section of these specifications.
- C. The types of architectural woodwork include, but are not necessarily limited to the following: Plastic laminate finished casework.

#### **1.3 QUALITY ASSURANCE**

- A. Quality Standards: Except as otherwise shown or specified, comply with specified provisions of the following: Architectural Woodwork Institute (AWI) "Quality Standards".
- B. Quality Marking: Mark each unit of architectural woodwork with mill's or fabricator's identification and grade mark, located on surfaces which will not be exposed after installation.
- C. Arrange for the fabrication and installation of architectural woodwork, with sequence matched laminates to be produced by a single firm.

#### **1.4 SUBMITTALS**

- A. Product Data: Submit manufacturer's specifications and installation instructions for each item of factory-fabricated woodwork.
- B. Shop Drawings: Submit shop drawings showing location of each item, dimensioned plans and elevations, large scale details, attachment devices and other components. Submit shop drawings for the following: Cabinets; counters; shelves.



- C. Samples: submit the following samples for each species and cut or pattern of architectural woodwork: Plastic laminate, 12" square; exposed cabinet hardware, one unit of each type and finish.

## 1.5 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Protect woodwork during transit, delivery, storage and handling to prevent damage, soiling and deterioration.
- B. Do not deliver woodwork until painting, wet work, grinding and similar operations which could damage, soil or deteriorate woodwork have been completed in installation areas. If, due to unforeseen circumstances woodwork must be stored in other than installation areas, store only in areas meeting requirements specified for installation areas.

## 1.6 JOB CONDITIONS

- A. Conditions: Installer shall advise Contractor of temperature and humidity requirements for woodwork installation areas. Do not install woodwork until required temperature and relative humidity have been stabilized and will be maintained in installation areas.
- B. Maintain temperature and humidity in installation area as required to maintain moisture content of installed woodwork within a 1.- percent tolerance of optimum moisture content, from date of installation through remainder of construction period. The fabricator of woodwork shall determine optimum moisture content and required temperature and humidity conditions.

## PART 2 - PRODUCTS

### 2.1 BASIC MATERIALS AND FABRICATION METHODS

- A. General: Except as otherwise indicated, comply with the following requirements for architectural woodwork not specifically indicated as prefabricated or prefinished standard products.
- B. Wood Moisture Content: Provide kiln-dried lumber with an average content range of 9% to 13% for exterior work and 6% to 11% for interior work. maintain temperature and relative humidity during fabrication, storage and finishing operations so that moisture content values for woodwork at time of installation do not exceed the following.
- C. Interior Wood Finish: 8% to 13% for damp regions (as defined by AWI).
- D. Exterior Trim: 9% to 14% for damp regions (as defined by AWI).

- E. Veneer: Plain sawed/sliced Red Oak.
- F. Veneer Matching: To be determined by fabricator, for best visual effect, depending upon flitch width and grain character. Refer questions of best visual effect to Architect for resolution as work progresses.
- G. Plastic Laminate: Comply with NEMA LD-3; type, thickness, color, pattern, and finish as indicated for each application.
- H. Quality Standards: For following types of architectural woodwork; comply with indicated standards as applicable.
- I. Design and Construction Features: Comply with details shown for profile and construction of architectural woodwork; and, where not otherwise shown comply with applicable Quality Standards, with alternate details as fabricator's option.
- J. Pre-Cut Openings; Fabricate architectural woodwork with pre-cut openings, wherever possible, to receive hardware, appliances, plumbing fixtures, electrical work and similar items. Locate openings accurately and use templates or roughing-in diagrams for proper size and shape. Smooth edges of cutouts and, where located in counter tops and similar exposures, seal edges of cutouts with a water-resistant coating.
- K. Measurements: Before proceeding with fabrication of woodwork required to be fitted to other construction, obtain measurements and verify dimensions and shop drawings details as required for accurate fit.
- L. Where sequence of measuring substrates before fabrication would delay the project, proceed with fabrication (without field measurements) and provide ample borders and edges to allow for subsequent scribing and trimming of woodwork, for accurate fit.

## 2.2 ARCHITECTURAL WOODWORK TYPES

### A. Plastic Laminate Finished Casework:

- 1. Premium Grade; Custom Grade.
- 2. Plastic Laminate for Horizontal Surfaces:
- 3. 0.050" thickness, General Purpose type (high pressure).

### B. Plastic Laminate for External Vertical Surfaces:

- 1. 0.028" thickness; general Purpose Type (high pressure).

C. Plastic Laminate for Postforming:

1. 0.042" thickness; postforming type (high-pressure).

D. Plastic Laminate for Cabinet Linings:

1. 0.020" thickness, cabinet lintel type (high pressure).

E. Plastic Laminate for Concealed Panel Backing:

1. 0.020" thick, backer type (high pressure).

F. Plastic Laminate Colors and Patterns:

1. Color: Wilson Art 05130-60 Beige. Submit sample for final approval by the owner user.
2. Fabricate exposed edges of casework, including edges of doors and drawers when open, with matching plastic laminate, except as otherwise indicated. Provide dust panels of 1/4" thick plywood or tempered hardboard above compartments and drawers, except where located directly below countertops.

2.3 FINISH FOR ARCHITECTURAL WOODWORK

- A. General: The entire finish of architectural woodwork is work of this Section, regardless of whether shop applied or applied after installation.
- B. Shop Finishing: To the greatest extent possible, finish architectural woodwork at shop or factory. Defer only final touch-up, cleaning and polishing for time after delivery and installation.
- C. The priming and prefinishing (if any) of architectural woodwork required to be performed at the shop or factory is specified as work of this section.
- D. Preparations for Finishing: Comply with AWI Quality Standards, Section 1500 for sanding, filling, countersunk fasteners, back priming and similar preparations for finishing of architectural woodwork, as applicable to each unit of work.
- E. Transparent Finish General: AWI Finish System No. 3e, Premium Grade, open grain finish.
- F. Shop Application: Sealer.

- G. Final Finish: Sanding; followed by 2 coats of clear alkyd-urea conversion varnish, rubbed to medium sheen.

## 2.4 CABINET HARDWARE AND ACCESSORY MATERIALS

- A. General: Provide cabinet hardware and accessory materials associated with architectural woodwork, except for units which are specified as "Door Hardware" in Section 8 or in other sections of these specifications.
- B. Hardware Standards: Except as otherwise indicated, comply with ANSI A-156.9 "American National Standard of Cabinet Hardware".
- C. Quality Level: Type 2 (Institutional), unless otherwise indicated.
- D. Cabinet Hardware Schedule: Install complete all specific hardware and accessories or approved equal required for architectural woodwork as follows:
  - 1. Drawer Slide, Grant 3320, extra heavy duty, or accepted equal
  - 2. Pull, Stanley 4484, US 26 D, or accepted equal
  - 3. Hinges, Stanley 332, US 26 D, or accepted equal
  - 4. Catches, 41, Stanley, Magnetic, or accepted equal
  - 5. Standard, Knape & Vogt 255, flush mounted, or accepted equal
  - 6. Support, Knape & Vogt 239, adjustable shelves, or accepted equal
- E. Cabinet Door Hardware: Provide hinges, catches and pulls of types indicated, to properly accommodate each door size and style.
- F. Locks: Where indicated, provide standard pin-type or disc-type (5 pins or discs) tumbler locks keyed individually except as otherwise indicated.
- G. Shelf Supports: Where shelving is indicated as "adjustable", provide slotted-type standards and brackets of type needed to properly support shelves with uniform 40-lb. per sq. ft. loading.

## PART 3 - EXECUTION

### 3.1 INSPECTION

- A. Examination: The Installer must examine substrates and conditions under which work is to be installed, and notify Contractor in writing of unsatisfactory conditions. Do not proceed with work until unsatisfactory conditions have

been corrected in a manner acceptable to Installer.

### 3.2 PREPARATION

- A. Condition woodwork to average prevailing humidity conditions in installation areas prior to installation.
- B. Pre-Installation Meeting: Meet at project site prior to delivery of architectural woodwork and review coordination and environmental controls required for proper installation and ambient conditioning in areas to receive work. Include in meeting the Contractor, Architect and other Owner Representatives (if any), installers of architectural woodwork, wet work such as plastering, other finishes, painting, mechanical work and electrical work, and firms or persons responsible for continued operation (whether temporary or permanent) of HVAC system as required to maintain temperature and humidity conditions. Proceed with woodwork installation only when everyone concerned agrees that required ambient conditions can be properly maintained.
- C. Deliver concrete inserts and similar anchoring devices to be built into substrates, well in advance of time substrates are to be built.
- D. Prior to installation of architectural woodwork, examine shop fabricated work for completion, and complete work as required, including back priming and removal of packing.

### 3.3 INSTALLATION

- A. Install the work plumb, level, true and straight with no distortions. Shim as required using concealed shims. Install to a tolerance of 1/8" in 8'-0" for plumb and level (including countertops); and with 1/16" maximum offset in flush adjoining surfaces, 1/8" maximum offsets in revealed adjoining surfaces.
- B. Scribe and cut work to fit adjoining work, and refinish cut surfaces or repair damaged finish at cuts.
- C. Casework: Install without distortion so that doors and drawers will fit openings properly and be accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete the installation of hardware and accessory items as indicated. Maintain veneer sequence matching (if any) of casework with transparent finish.
- D. Countertops: See section 06601 Solid Surfacing Fabricators

### 3.4 ADJUSTMENT, CLEANING, FINISHING AND PROTECTION

- A. Repair damaged and defective woodwork wherever possible to eliminate

- defects functionally and visually; where not possible to repair properly, replace woodwork. Adjust joinery for uniform appearance.
- B. Clean hardware, lubricate and make final adjustments for proper operation.
  - C. Clean woodwork on exposed and semi-exposed surfaces. Touch-up shop applied finishes to restore damaged or soiled areas.
  - D. Complete the finishing work specified as work of this Section, to whatever extent not completed at shop or prior to installation of woodwork.
  - E. Protection: Installer of architectural woodwork shall advise Contractor of final protection and maintained conditions necessary to ensure that work will be without damage or deterioration at time of acceptance.

END SECTION 06410

## SECTION 06601 - SOLID SURFACING FABRICATIONS

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section Includes:
  - 1. Countertops
  - 2. Backsplash/ Skirts/Trim
  - 3. Other Miscellaneous work depicted on the drawings.

#### 1.2 Related Documents

- A. Drawings and General Provisions of the Contract, including General and Supplemental Conditions and Division 1 apply to this section:
  - 1. Related work Section 10800 Toilet Accessories, Division 5 Metals, Division 15 Plumbing, Division 16 Electrical Work

#### 1.2 SUBMITTALS

- A. Product Data: Manufacturer's data sheets on each product to be used, including:
  - 1. Details of fabrication.
  - 2. Recommendations for handling, protection, and maintenance.
  - 3. For fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements.
- B. Shop Drawings: Show assembly methods, joint details, and accessories.
  - 1. Show field measurements and concealed framing, blocking, and reinforcement locations
- C. Samples: For each finish product specified, two complete sets of color chips representing manufacturer's full range of available colors and patterns.

#### 1.3 QUALITY ASSURANCE

- A. Supply lavatory countertops from one manufacturer.
- B. Tolerances:
  - 1. Variation in component size: +/- 1/8 inch
  - 2. Location of openings: +/- 1/8 inch from indicated location
- C. Perform work to custom quality in accordance with "Quality Standards" of the Architectural Woodwork Institute (AWI).
- D. Fire-Test-Response Characteristics: Provide materials and products with specified fire-test-response characteristics as determined by testing identical products per test method indicated by UL or another nationally known testing and inspecting agency acceptable to authorities having jurisdiction. Identify with appropriate markings of applicable testing and inspecting agency in the form of separable paper label or, where required by authorities having jurisdiction, imprint on surfaces of materials that will be concealed from view after installation.

#### 1.4 DELIVERY, STORAGE, AND HANDLING

- A. Do not deliver cast polymer materials until painting and similar operations that could damage synthetic marble have been completed in installation areas. If cast polymer materials must be stored in other than installation areas, store only in areas where environmental conditions comply with requirements specified in "Project Conditions" Article.
- B. Handle materials to prevent damage to finished surfaces. Provide protective coverings to prevent physical damage or staining following installation for duration of project.

#### 1.5 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install cast polymer materials until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.
- B. Field Measurements: Where cast polymer materials are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication.
  - 1. Coordinate concealed framing, blocking, and reinforcements that support cast polymer materials work.

### PART 2 - PRODUCTS

#### 2.1 CAST POLYMER

- A. Manufacturer: Corian or approved equal, Color to be selected by Architect.
- B. Fire Hazard Ratings:
  - 1. 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
- C. Countertops:
  - 1. Homogeneous cast polymer countertops. Thickness, sizes and profiles as shown on Drawings.
    - a. Provide matching backsplash, sidesplash, aprons and other accessories as shown on Drawings and specification in same material, color and finish.

#### 2.2 INSTALLATION MATERIALS

- A. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide nonferrous-metal or stainless steel anchors and inserts on inside face of exterior walls and elsewhere as required for corrosion resistance. Provide toothed-steel or lead expansion sleeves for drilled-in-place anchors.
- B. Sink Mounting Hardware: Manufacturer's standard bowl clips, panel inserts



and fasteners for attachment of undermount sinks/lavatories.

C. Adhesive and Sealant: As recommended by cast polymer manufacturer.

(Installer to verify products are approved by Cast polymer materials Manufacturer.)

2.3 FABRICATION

A. General:

1. Shop assemble cast polymer materials for delivery to Site in units easily handled and to permit passage through building openings.
2. Shop cut openings, to maximum extent possible, to receive hardware, accessories, plumbing fixtures, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings.
  - a. Rout and finish component edges with clean, sharp returns. Rout cutouts, radii and contours to template. Smooth edges. Repair or reject defective and inaccurate work.
3. When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide trip for scribing and site cutting.
4. Provide cutouts for plumbing fixtures, inserts, appliances, outlet boxes, accessories, control and other fixtures and fittings.
5. Provide for mounting of accessories indicated on the Drawings and Specification.
6. Edge treatment as indicated on drawings, or radius corners.

2.4 PERFORMANCE CHARACTERISTICS: CORIAN

or approved equal.

Property	Typical Result	Test
Tensile Strength	6,000 psi	ASTM D 638
Tensile Modulus	1.5 x 10 <sup>-6</sup> psi	ASTM D 638
Tensile Elongation	0.4% min.	ASTM D 638
Flexural Strength	10,000 psi	ASTM D 790
Flexural Modulus	1.2 x 10 <sup>-6</sup> psi	ASTM D 790
Hardness	>85	Rockwell "M" Scale ASTM D 785
	56	Barcol Impressor ASTM D 2583

Thermal Expansion	3.02 x 10 <sup>-5</sup> in./in./°C (1.80 x 10 <sup>-5</sup> in./in./°F)	ASTM D 696
Gloss (60° Gardner)	5–75 (matte—highly polished)	ANSI Z124
Light Resistance	(Xenon Arc) No effect	NEMA LD 3-2000 Method 3.3
Wear and Cleanability	Passes	ANSI Z124.3 & Z124.6
Stain Resistance: Sheets	Passes	ANSI Z124.3 & Z124.6
Fungus and Bacteria Resistance	Does not support microbial growth	ASTM G21&G22
Boiling Water Resistance	No visible change	NEMA LD 3-2000 Method 3.5
High Temperature Resistance	No change	NEMA LD 3-2000 Method 3.6
Izod Impact (Notched Specimen)	0.28 ft.-lbs./in. of notch	ASTM D 256 (Method A)
Ball Impact Resistance: Sheets	No fracture—1/2 lb. ball: 1/4" slab—36" drop 1/2" slab—144" drop	NEMA LD 3-2000 Method 3.8
Weatherability	ΔE* <sub>94</sub> <5 in 1,000 hrs.	ASTM G 155
Specific Gravity †	1.7	
Water Absorption	Long-term 0.4% (3/4") 0.6% (1/2") 0.8% (1/4")	ASTM D 570
Toxicity	99 (solid colors)	Pittsburgh Protocol

66 (patterned colors)

Test ("LC50"Test)

Flammability

All colors  
(Class I and Class A)

ASTM E 84,  
NFPA 255 &  
UL 723

Flame Spread Index

<25

Smoke Developed Index

<25

† Approximate weight per square foot: 1/4" (6 mm) 2.2 lbs., 1/2" (12.3 mm) 4.4 lbs.

Shapes meet or exceed the ANSI Z124.3 and ANSI Z124.6 standards for plastic sinks and lavatories.

NEMA results based on the NEMA LD 3-2000

### PART 3 - EXECUTION

#### 3.1 INSPECTION

- A. Verify adequacy of backing and support framing. Do not start installation until unsatisfactory conditions have been corrected.

#### 3.2 PREPARATION

- A. Condition cast polymer materials to average prevailing humidity conditions in installation areas a minimum of 24 hours before installation.

#### 3.3 INSTALLATION

- A. All countertops and accessories shall be installed as shown on Drawings and as specified. Follow manufacturers installation instructions.
- B. Install components plumb, level and rigid, scribed to adjacent finishes, in accordance with final Shop Drawings and product data.
- C. Adhere sinks and lavatory bowls to tops using manufacturer's recommended mounting hardware. Wipe clean with denatured alcohol to remove any contaminants prior to applying adhesives.
- D. Countertops:
  - 1. Quality Standard: Comply with AWI Section 400 requirements for countertops.
  - 2. Anchor securely by screwing through corner blocks of base cabinets or other supports into underside of countertop.
  - 3. Install countertops with no more than 1/8 inch in 96 inch sag, bow, or other variation from a straight line.

4. Provide cutouts for the installation of plumbing fixtures.
5. Provide backsplashes, sidesplashes, and aprons as indicated on the Drawings. Adhere to tops using manufacturer's standard color-matched silicone sealant.

E. Sinks:

1. Secure lavatory bowls to tops using manufacturer's recommended sealant, adhesive and mounting hardware to maintain warranty.

3.4 ADJUSTING AND CLEANING

- A. Keep components clean during installation. Remove adhesives, sealants and other stains. Keep clean until Date of Substantial Completion. Replace stained and damaged components.
- B. Protect surfaces from damage until Date of Substantial Completion. Repair work or replace damaged work which cannot be repaired to Owner's Representative's satisfaction.

END OF SECTION 06601

## **SECTION 07193 - VAPOR BARRIERS**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

- A. The General Conditions of the Contract, including General Requirements of Division 1, apply to the work specified in this Section.

#### **1.2 DESCRIPTION**

- A. The work under this Section includes all labor, material, equipment and services necessary to complete the vapor barrier work as shown on the drawings and herein specified.

#### **1.3 SUBMITTALS**

- A. Manufacturer's Data, Vapor Barriers:
- B. Submit Data, material data, accessories, installation instructions and general recommendations.
- C. Safety data sheets of product.

### **PART 2 - PRODUCTS**

#### **2.1 VAPOR BARRIER UNDER SLABS**

- A. Minimum 15 mil thickness membrane. "Stego Wrap" is the basis of design or approved equal.

#### **2.2 Tape**

- A. Tape as recommended by the manufacturer of the vapor barrier.

### **PART 3 - EXECUTION**

#### **3.1 PREPARATION**

- A. Do not install vapor barrier until soil compaction and treatment is complete.

#### **3.2 INSTALLATION**

- A. Placing: Vapor barrier shall be unrolled allowing for a minimum overlap of 6" over the treated, compacted subgrade and turned down at the inside perimeter of foundations at vertical surfaces provide a minimum overlap of

- 6". Install approved manufacturers tape at the edge of all laps continuous.
- B. Penetration: Where pipes and conduits pass through the membrane, it shall be doubled in thickness and sealed with a pressure sensitive tape or cement as recommended by the manufacturer.
- C. Do not puncture vapor barrier with steel reinforcement. Repair all punctures with tape or another layer of visqueen over puncture.
- D. Install continuous tape at all vertical overlaps.

### 3.3 ADJUST AND CLEAN

- A. Inspect the membrane thoroughly and repair all punctures immediately before placing concrete. Equipment, tools, and procedures that might puncture the membrane shall not be used while placing and finishing concrete or installing insulation.

END SECTION 07193

## **SECTION 07200 - THERMAL INSULATION**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

- A. The General Provisions of the Contract, including General and Supplementary Conditions and General Requirements, apply to the work specified in this section.
- B. Insulation for Pre-engineered Metal Buildings and roof of Office Building is specified in Section 13120

#### **1.2 DESCRIPTION OF WORK**

- A. The extent of thermal insulation work is shown on the drawings, by the generic name of by its abbreviation. The applications of thermal insulation specified in this section include the following:
  - 1. Foam cavity wall insulation.
  - 2. Rigid board insulation over exterior CMU.
  - 3. Mineral wool blanket sound attenuation and fire batt insulation installed in the cavity of metal studs.
  - 4. Thermal insulation at metal roofs and metal wall panels.
  - 5. Other insulation as required by the project conditions.

#### **1.3 QUALITY ASSURANCE**

- A. Thermal Conductivity: The thicknesses shown are for the thermal conductivity (k-value at 75 degrees F.) specified for each material. Provide adjusted thicknesses as directed for the equivalent use of material having a different thermal conductivity.
- B. Fire and Insurance Ratings: Comply with the fire-resistance, flammability and insurance ratings indicated, FM, UL and comply with governing regulations as interpreted by authorities.

#### **1.4 SUBMITTALS**

- A. Manufacturer's Data, Thermal Insulation: Submit 6 copies of manufacturer's specifications and installation instructions for each type of insulation required. Include data substantiating that materials comply with specified requirements.

#### **1.5 PRODUCT HANDLING**

- A. Protection from Deterioration: Do not allow insulation materials to become

wet, soiled, or covered with ice or snow. Comply with manufacturer's recommendations for handling, storage and protection during installation.

## 1.6 JOB CONDITIONS

- A. Examination of Substrates: The Installer must examine the substrate and the conditions under which the insulation work is to be performed, and notify the Contractor in writing of unsatisfactory conditions. Do not proceed with the insulation work until unsatisfactory conditions have been corrected in a manner acceptable to the Installer.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. Extruded Polystyrene Foam Insulation: "Styrofoam Brand Utilityfit XPS 15. R-5 per 1" of thickness, square Edge. UL D369, ASTM D-1621 for Compressive strength, ASTM C 272 max .03% Water Absorption.
- B. Mineral/glass fiber blanket/batt insulation: Inorganic fibers formed into flexible resilient blankets or semi-rigid resilient sheets: ASTM C665 Type I and ASTM E136: density as indicated, but 1.0 lb. Minimum; k-value of 0.27 where thickness is indicated, or k-value and thickness as required to provide "R" value as indicated; manufacturer's standard lengths and widths as required to coordinate with spaces to be insulated:
1. Certain Teed – Thermal Batt Insulation unfaced.
  2. Johns-Manville – Thermal Batt Insulation unfaced.
  3. Owens-Corning – Thermal Batt Insulation unfaced.
- C. Foam Insulation
1. Core-Fill 500 Foam insulation, 60lbs density developing a "R" value for 8" CMU of 14.2 and a "U" value of 0.07. Flame spread of not to exceed 25. Smoke developed of not more than 450 as per ASTM E-84. As manufactured by:
    - a) Tailored Chemical Products or approved equal.
- D. Miner/glass fiber board insulation inorganic fibers with a thermo setting resin binder into semi rigid boards: ASTM C612, type IA and IB: density as indicated, 3.0 PCF; K-value 23
1. Owens-Corning type 703, unfaced.



2. Or approved equal.

E. Mineral wool blanket/batt insulation: Inorganic fibers formed into flexible resilient blankets. Classified non-combustible ASTM E-136, ASTM C-665, Type I sound attenuation fire batt insulation/MW/mineral wool.

1. Owens-Corning, sound attenuation and fire batt insulation/mineral wool or acceptable equal.

F. Thermal insulation glass fiber blanket insulation with white vapor barrier, comply with ASTM C991, of 0.5 lb per cu. ft. density, thickness to achieve required R value on drawings, with UL flame spread classification of 25 or less, the vapor barriers have 2" wide continuous vapor -tight edge tabs.

1. Office building support blanket with galvanized mesh wire between bar joist.

## 2.2 MISCELLANEOUS MATERIALS

A. Mechanical Anchors: type and size shown or, if not shown, as recommended by insulation manufacturer for type of application and condition of substrate.

B. Galvanized expanded metal mesh support.

C. Adhesives.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

A. General: Comply with manufacturer's instructions for the particular conditions of installation in each case. If printed instructions are not available or do not apply to the project conditions, consult the manufacturer's technical representative for specific recommendations before proceeding with the work.

1. Do not install insulation in wet conditions.

B. Masonry-Cell Insulation:

1. Fill insulation into cavities as shown, to completely fill the void spaces. Maintain inspection ports to show presence of insulation at the extremities of each fill area. Close ports after complete coverage has been confirmed.

- C. Extend insulation full thickness as shown over entire area to be insulated. Cut and fit tightly around obstructions, and fill voids with insulation. Remove projections, which interfere with placement.
- D. Cover extruded polystyrene foam insulation with gypsum wall board, all joints will be taped and finished on all exposed edges of wall or wall cavity.
- E. Apply a single layer of insulation of the required thickness, unless otherwise shown or required to make up the total thickness.
- F. Install foam product following the manufacturer's recommendations for mixing, installing, and curing.

### 3.3 GENERAL BUILDING INSULATION

- A. Pour granular insulation into spaces and onto surfaces as shown. Screed horizontal applications to uniform thicknesses indicated.
- B. Provide either perlite or vermiculite into miscellaneous voids and cavity spaces as indicated. Compact to approximately 40% of normal maximum volume to a density of approximately 2.5 lbs. per cu. ft.
- C. Protect voids and cavities for concrete cells, columns, lintels, bond beam, and concrete beam forms free of insulation material. Clean completely of any loose fill insulation.
- D. Apply insulation units to the substrate by the method indicated, complying with the manufacturer's recommendations. If no specific method is indicated, bond units to substrate with mechanical anchorage to provide permanent placement and support of units.
- E. Stuff loose mineral fiber insulation into miscellaneous voids and cavity spaces as indicated. Compact to approximately 40% of normal maximum volume to a density of approximately 2.5 lbs. per cubic foot.

END SECTION 07200

## **SECTION 07270 – FIRESTOPPING/DRAFTSTOPPING**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

- A. The general provisions of the Contract, including General and Supplementary Conditions and General Requirements (if any), apply to the work specified in this section.

#### **1.2 DESCRIPTION OF WORK**

- A. The extent of firestopping/draftstopping shown on the drawings and specified herein.
- B. Provide all labor, materials, equipment and services necessary for, and incidental to, the complete and proper installation of all firestopping/draftstopping and related work as shown on the drawings and specified herein, and in accordance with all applicable requirements of the Contract Documents.
- C. Firestopping/draftstopping all thru wall penetration at walls for multiple metallic conduits, duct banks, single conduits/pipes, complete.
- D. Firestopping/draftstopping of all electrical, telephone, mechanical, fire protection and plumbing penetrating vertical and horizontal rated assemblies complete.
- E. Firestopping/draftstopping of gap between the top of wall partitions and roof deck.
- F. The material and installation shall conform to applicable building code requirements and the requirements of all authorities having jurisdiction.
- G. The intent of draft stopping is to keep exterior air from infiltration to the interior of the building and into voids and cavities of the walls.

#### **1.3 QUALITY ASSURANCE**

- A. Work shall be performed by a firm with expertise in the installation of firestopping or similar materials. This firm shall be certified or otherwise approved by the firestopping material supplier. The firm must show a min of 3 successful installations with references.

#### 1.4 SUBMITTALS

- A. Schedule of materials list of all items proposed for the Work of this Section.
- B. Manufacturer's certifications, specifications and all technical data necessary to demonstrate compliance with the requirements of this Section. Show details of each condition as occurs within the project. Provide UL designation for each detail and condition.
- C. Manufacturer's product data.
- D. Manufacturer's recommend installation procedures which, when approved by the Architect, will become one of the bases for inspecting the Work.
- E. Keyed plan showing location of proposed assembly with crossed reference to UL detail.

#### 1.5 RELATED SECTIONS

Section 01300	Submittal
Section 03300	Cast-in-Place Concrete
Section 04220	Unit Masonry
Section 09250	Gypsum Drywall
Division 15 -	Mechanical
Division 16 -	Electrical

#### 1.6 REFERENCES

- ASTM E84 - Surface Burning Characteristics of Building Materials
- ASTM 814 - Fire Tests of Through Penetration Firestops
- UL 1479 - Fire Tests of Through Penetration Firestops.
- UL Fire Resistance Directory Vol. II.
- Model Building Code(s): Florida Building Code, latest edition
- NFPA 101 - Life Safety Code
- NFPA 70 - National Electric Code

#### 1.7 DELIVERY, STORAGE AND HANDLING

- A. Deliver materials to the project in supplier's unopened packages, fully identified as to trade name, and other identifying data. Packaging shall bear the UL label for fire-resistance.
- B. Store materials above ground, in a clean, dry location, protected from the weather. Damaged packages found unsuitable for use should be removed from the project.

## 1.8 PROJECT CONDITIONS

- A. Do not proceed with installation of firestopping/draftstopping when temperature or humidity conditions exceed the manufacturer's recommendations.
- B. Provide adequate ventilation to allow proper curing of firestopping.

## 1.9 SEQUENCING/SCHEDULING

- A. Schedule installation of firestopping after installation of penetrating item and prior to concealment.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. The specifications were written based on:
  - Isolate K International, Stanhope, NJ  
(201) 347-1200
- B. Other manufacturers
  - 3M Company, Fire Master Protection System, or approved equal.
  - Hilti Firestop, Tulsa, OK, or approved equal.
  - STI, Specified Technologies, Inc., Somerville, N.J. or approved equal.

### 2.2 MATERIALS

- A. CAFCO TPS brand firestop products or acceptable equal.
- B. Materials shall be installed to conform to the drawings and specifications.
- C. Materials shall have been tested in accordance with ASTM E814 or UL 1479,

- the Standard Method of Fire Tests of Through Penetration Firestops, or equivalent.
- D. System design shall provide a fire-resistance rating equal to or exceeding the fire-resistance rating of the floor or wall construction being penetrated.
  - E. Materials shall be water resistant and shall be insoluble in water when cured.
  - F. Materials shall be compatible with all materials used in the construction. Solvent based materials shall not be used.
  - G. Flammability: materials shall pose no fire hazard in storage installation during curing or while in service.
  - H. Materials shall be tested in accordance with ASTM E84 "Standard Method for Surface Burning Characteristics of Building Materials" and shall comply with the interior finish flame spread and smoke developed requirements for the area of installation.
  - I. Installations subject to movement or vibration shall be sealed with materials designed to perform under these conditions.
  - J. Installations subject to frequent changes of penetrating item(s) shall be sealed with materials designed to be refitted without damage to the system.
  - K. Portable water shall be used for materials requiring premixing with water.

## 2.3 DRYWALL

### A. TOP OF DRYWALL FIRESTOPPING/DRAFTSTOPPING

1. Applied at relief area above gypsum
2. Packing material: 3.5 PCF mineral wool batt insulation firmly packed to 7 PCF.
3. Rating Warnock Hersey # WHI - 495 - PSV - 1095A, or approved equal.

## 2.4 WALL PENETRATIONS

- A. Around penetration of metallic conduits.  
Provide product from listed manufacturers that will comply with UL listing for the system application.

## 2.5 MISC. PENETRATIONS

- A. Provide UL approved material and system installation for the proposed

penetrations.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Verify penetrations are sized in accordance with drawings and specifications and are suitable to receive firestopping material.
- B. All surfaces to receive firestopping shall be free of oil, grease, loose mill scale, dirt, or other materials which would impair satisfactory fitting or bonding or, which may affect the fire resistance rating. Any cleaning of surfaces shall be the responsibility of the General Contractor.
- C. Provide masking or drop cloths to prevent damage to adjacent areas.
- D. Power to exposed cable in the work area shall be shut off.
- E. Cable jacking shall be inspected and any damage shall be reported to the General Contractor before proceeding.
- F. The General Contractor shall schedule a pre-installation meeting to establish procedures to maintain efficient, coordinated working conditions between installer and other trades.
- G. Provide all necessary forming of large penetrations.

### 3.2 INSTALLATION

- A. Install all materials per system requirements in accordance with manufacturer's instructions and tested assembly/system.
- B. The application of firestopping shall not commence until requiring firestopping have been inspected by the installer and are acceptable to receive firestopping. Do not install until all conditions of adjacent surfaces are in compliance with the installation of the system assembly requirements.
- C. All unsuitable surfaces must be identified and made known to the General Contractor and corrected prior to the installation.
- D. Proper temperature and ventilation shall be maintained as specified on manufacture's installation instructions.

### 3.3 MATERIALS HANDLING

- A. Deliver fireproofing material in original bags bearing manufacturer's name,

brand and U.L. label for fire-resistance classification required. Store off ground and protect form elements and contamination.

- B. Use all necessary means to protect the material before, during and after application and to protect the work and materials of all other trades from overspray. Enclose exterior openings where spraying.

### 3.4 APPLICATOR

- A. Do all work under supervision of an certified applicator who is completely familiar and trained with all methods for performance of the work.

### 3.5 COORDINATION

- A. Place any clips, supports, connections, sleeves and such attachments prior to application. Install ducts, piping, conduit and such suspended items after application.

### 3.6 PROTECTION, CLEANING

- A. Protect all adjacent surfaces from unintentional application.
- B. In addition to requirements of GENERAL CONDITIONS, on completion of the work, inspect adjacent surfaces and promptly remove all material spills and spattering.

### 3.7 REPAIRING

- A. Repair firestopping, draftproofing due to damage after installation.
- B. In the event of damage to or diminishment of the material, immediately perform all necessary patching and repairing to indicated thickness and condition, to Architect's approval at no cost to Owner.

### 3.8 INSPECTION AND TESTING

- A. Do not cover firestop systems until they have been properly inspected and accepted by the authorities having jurisdiction.

### 3.9 WALL STENCIL

- A. Stencil in red paint the wall rating and the UL# assembly used with permanent label.



THREE POINTS MAINTENANCE FACILITY  
ORANGE COUNTY, FLORIDA

SECTION 07270  
FIRESTOPPING/DRAFTSTOPPING

END SECTION 07270

## SECTION 07613 - STANDING SEAM METAL ROOFING

### PART 1 - GENERAL

#### 1.1 SECTION INCLUDES

- A. Standing seam metal roofing, ridge, hips, valleys, gutters, downspout, expansion and accessory sheet metal work for the system, all as indicated on Drawings and specified, complete.

#### 1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Rough Carpentry: Section 06100
- B. Steel Bar Joist: Section 05220
- C. Metal Decking: Section 05300
- D. Flashing and Sheet Metal: Section 07600
- E. Joint Sealants: Section 07920

#### 1.3 QUALITY ASSURANCE

##### A. Requirements:

##### 1. Comply with following requirements::

- a. UL: Class A fire rated.
- b. Product approvals for low slope application NOA No. 09-0224.04
- c. See structural drawing for wind load and pressure diagram requirements for roof and accessories.

##### B. Reference specifications and standards:

- 1. SMACNA: "Architectural Sheet Metal Manual", Sheet Metal and Air Conditioning Contractors National Association, Inc.
- 2. ASTM: B32 Solder Metal.
- 3. ASTM: B370 Copper Sheet and Strip for Building Construction.
- 4. ASTM D412 Standard Test Methods for Vulcanized Rubber and Thermoplastic Rubbers and Thermoplastic Elastomers in Tension.
- 5. ASTM D903 Standard Test Method for Peel or Stripping of Adhesive Bonds
- 6. ASTM D3767 Standard Practice for Rubber-Measurement of Dimensions
- 7. ASTM E96 Standard Test Methods for Water Vapor Transmission of Materials
- 8. AISC: "Steel Construction Manual", American Institute of Steel Construction.

11. AISI: "Cold Form Steel Design Manual", American Iron and Steel Institute.
12. UL: "Tests for Uplift Resistance of Roof Assemblies", Underwriters Laboratories, Inc.
13. UL: "Test Standard For Impact Resistance", Underwriters Laboratories, Inc.
14. UL: Flame Spread Classification Test – UL790
15. ASTM E 1592-95: "Standard Test method for Structural Performance of Sheet Metal Roof and Siding Systems by Uniform Static Air Pressure difference", American Society for Testing and Materials. #16 wide, 22 gauge only.
16. ASTM E 1680-95: " Standard Test Method for Rate of Air Leakage Through Exterior Metal Roof Panel Systems", American Society for Testing and Materials.
17. ASTM E 1646-95: " Standard Test Method for Water Penetration of Exterior Metal Roof Panel Systems by Uniform Static Air Pressure Difference", American Society for Testing and Materials.
20. ASTM A 792-83-AZ50: "Specifications for Steel Sheet, Aluminum-Zinc Alloy Coated (Galvanized) by the Hot Dip Process, General Requirements (Galvalume\*)", American Society for Testing and Materials.
21. ASTM E 1514-93: "Standard Specification for Structural Standing Seam Steel Roof Panel Systems", American Society for Testing and Materials.
22. Florida Building Code 2010

#### 1.4 WARRANTY

- A. Submit manufacturer's written 20 year warranty covering durability of roof and wall panels against rupture, structural failure or perforating, and panel finish against blistering, peeling, cracking, flaking, chipping, excessive color change, and chalking.

#### 1.5 SUBMITTALS

- A. Procedures: In accord with Section 01300.
- B. Samples:
  1. 12 in. square made-up sample of typical roof section with standing seam and accessories.
  2. 12 in. square color samples of manufacturer's standard colors for selection of finish colors by Owner.

- C. Shop drawings: Plans of roof showing layout of pans, larger scale details showing pan sections, standing seam, methods of attachment, and flashing.
  - 1. Indicate materials, gauges, dimensions, fabrication, roof layout and erection details.
  - 2. Fastener details and spacing.
  - 3. Field verify roof dimensions.
- D. Product data: Manufacturer's detailed specifications, literature and catalog cuts for each manufactured item.
- E. Certificates:
  - 1. Fabricator's certification that materials meet specified requirements.
  - 2. Installer certification by the roof manufacturer as an accepted installer of the product.
  - 3. Fabricator certification that the materials and assemblies include UL Fire Class and NOA wind requirements.
  - 4. Pull out test results for anchors of clips to steel deck.
- G. Submit signed and sealed engineering calculation confirmation of compliance of cladding loads for all roof areas based on specified wind load condition and wind pressure requirements. allowable clip loads, type of clip, clip fastener and spacing required number of fasteners to secure the panel clips to the roof deck.
  - 1. Provide valley capacities for the applicable rainfall intensity in accordance with Florida Building Code 2010 and Florida Plumbing Code 2010..

#### 1.6 PRODUCT HANDLING

- A. Procedures: follow manufacturers instructions for storage & handling of all materials.
- B. Protect metal roofing components from damage. Store in closed containers on pallets off the ground and protect from weather with tarp covers.

#### 1.7 PREROOFING CONFERENCE

- A. Prior to commencement of roofing and associated work, meet at project site or other mutually agreed upon location, with installer, manufacturer's representative, installers of related work, and other entities concerned with roofing performance, including (where applicable) Owner's insurer, test agencies, governing authorities, and Owner. Record results of pertinent discussions and agreements, and furnish copy to each participant. Provide at least 72 hours advance notice to participants prior to convening preroofing conference.

#### 1.8 TESTING

- A. Conduct clip fastener pull out test to confirm minimum requirements. All testing will be witnessed by Independent Testing agency paid for by the owner and performed by the contractor. Coordinate all testing agency. A copy of the Test results will be provided to the Architect and owner.

## 1.9 WARRANTY

- A. 20 year warranty for:
  - 1. Materials and workmanship
  - 2. Watertight
  - 3. Paint finish

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. Type: 22 gauge minimum, aluminum-zinc alloy coated steel, precision roll-formed panels in design configuration as selected by Owner.
  - 1. Coating: Approximately 55% aluminum and 45% zinc, applied by continuous hot-dip process to achieve 0.5 oz., total both sides, of aluminum-zinc alloy per square foot of coated sheet.
- B. Finish: Thermosetting silicone-type to dry film thickness of 1 mils to provide 10-year warranty. (Kynar 500 Coating).
- C. Sealant: In accord with Section 07920.
- D. Gutter and Rain Leader: 22 GA. S.S. metal gutter with combination hanger with flat bar. 22 GA, galvanized S.S., gutter, rain leader with bends and elbows. Both will be field painted to match the roof color selected.

### 2.2 MANUFACTURER

- A. IMETCO, Innovative Metals Company, Inc. 2070 Steel Drive, Tucker, GA 30084-5832 (770) 908-1030, FAX (770) 908-2264 (800) M-IMETCO
- B. Or approved substitution.

### 2.3 PRODUCT

- A. Series 300 standing seam by IMETCO: Metal roof system that complies with NOA 09-0224.04 or approved equal.
  - 1. Panels: 22 GA Structural Galvalume Steel Roof Panel, standing seam,
  - 2. Clips: 16 Ga 40KSI G-90 Coated Steel Clips..
  - 4. Fasteners: All fasteners type spacing, sizes to comply with NOA assembly and structural loads listed on the drawings.

5. Finish: Premium Fluorocarbon Coating produced with Kynar 500 resin. Color as noted on the drawing .
6. Prefab Roof Jack:
  - a. Construction Fasteners, Wyomissing, PA
  - b. ITW Buildex, Itasca, IL
  - c. Supplied by manufacturer
7. Class A fire rating in accordance with UL 790
8. Miami Dade approved # 09-0224.04

## 2.4 MISCELLANEOUS MATERIALS

### A. Fasteners:

1. All roof fasteners shall be stainless steel.
2. All self-tapping/self-drilling fasteners, bolts, nuts, self-locking rivets and other suitable fasteners shall be provided and installed to withstand loads required to meet structural load criteria.
3. Provide neoprene washers under heads of exposed fasteners as accepted by or if required by roof manufacturer to maintain a watertight roof.
4. Locate and space all exposed fasteners in a true vertical and horizontal alignment. Use proper torque settings to obtain controlled uniform compression for positive seal.

### B. Accessories:

1. Provide all components required per the metal roof system manufacturer's accepted shop drawings for a complete metal roof system to include panels, panel clips, trim/flashing, fascias, ridge, closures, sealants, fillers underlayment and other required components..
  - a. All outside closures will be fabricated from Galvalume Plus sheet steel of the same gauge, finish and color as the panels.
  - b. All tape seal is to be a pressure sensitive, 100 percent solids, polyisobutylene compound sealing tape with a release paper backing. Provide permanently elastic, non-sagging, non-toxic, non-staining tape seal accepted by the metal roof system manufacturer.
  - c. Joint sealant is to be a Butyl sealant accepted by the metal roof system manufacturer.

## 2.5 SHOP FABRICATION

### A. General:

1. Make allowance for expansion and contraction of metal components. Provide for 1/8 in. change per 10 ft. of pan length per 100°F.

2. Fabricate components in accord with referenced SMACNA manual.
  3. Fabricate components with lines, rises and angles sharp and true, and free from wave, warp and buckle.
- B. Pans: Custom form from prefinished 18 gauge sheet steel. Provide one-piece continuous formed sections from ridge to eave without transverse seams.
1. Pan width: See roof drawings for custom parapet pan size.
  2. Seam height: 2-3/8 in.
- C. Clips: Fabricate to conform to NOA and Signed and sealed accepted assembly requirements. Provide quantity required for spacing to meet wind loads.

### PART 3 - EXECUTION

#### 3.1 INSPECTION

- A. Examine surfaces for conditions that will adversely affect execution, permanence and quality of work.
- B. Do not proceed with work until unsatisfactory conditions have been corrected.
- C. Conduct pull out tests for support clips.

#### 3.2 INSTALLATION OF METAL ROOFING

- A. Secure clips to decking at spacing o.c. per FM class 1-135 requirements.
  - B. Install pans and close seams with a double lock in accord with SMACNA and FM assembly requirements.
  - C. Solder terminations and joint intersections of standing seams if bare metal is exposed.
  - D. Completed roof shall be free from water leakage under all rain and wind conditions.
  - E. Clean roof in accordance with manufacturer's recommendation prior to theme painting.
  - F. Touch up minor scratches and abrasions with touch-up paint supplied by the manufacturer.
- B. Do not allow panels or trim to come in contact with dissimilar metals such as copper, lead, or graphite. Provide isolating material to separate dissimilar materials from contact.

- C. Clean all Portland Cement dropping from surfaces immediately clear per manufacturers instructions.
- I. Install metal roof system so that it is water tight, without waves, warps, buckles, fastening stresses or distortion, allowing for expansion and contraction.
- J. Install metal roof system in accordance with manufacturer's instructions and shop drawings.
- K. Provide concealed anchors at all panel attachment locations.
- L. Install panels plumb, level and straight with seams and ribs in radial pattern shown on drawings parallel, conforming to design as indicated.

### 3.5 PREFABRICATED ROOF JACK

- A. Comply with metal roof system manufacturer's shop drawings, instructions and recommendations for installation of roof jacks. Refer to metal roof system manufacturer's standard installation details. Anchor jacks securely in place with provisions for thermal and structural movement.

### 3.6 Do not penetrate roof with any other kind of penetrations.

END SECTION 07613



## **SECTION 07620 - SHEET METAL FLASHING AND TRIM**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

- A. Drawings and General conditions provisions of the contract including contractual conditions, and division 1 specifications.

#### **1.2 SUMMARY**

- A. This Section includes sheet metal flashing and trim in the following categories:
  - 1. Copings.
  - 2. Metal flashing.
  - 3. Self-adhering flashing.

#### **1.3 PERFORMANCE REQUIREMENTS**

- A. General: Install sheet metal flashing and trim to withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failing.

#### **1.4 SUBMITTALS**

- A. Product Data: Include manufacturer's material and finish data, installation instructions, and general recommendations for each specified flashing material and fabricated product.
- B. Shop Drawings: Of each item specified showing layout, profiles, methods of joining, and anchorage details.
- C. Samples: Of sheet metal flashing, trim, and accessory items, in the specified finish. Where finish involves normal color and texture variations, include Sample sets composed of 2 or more units showing the full range of variations expected.
  - 1. 8-inch- square Samples of specified sheet materials to be exposed as finished surfaces.
  - 2. 12-inch- long Samples of factory-fabricated products exposed as finished Work. Provide complete with specified factory finish.
- D. Qualification Data: For firms and persons specified in the "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and Owners, and other information specified.

## 1.5 QUALITY ASSURANCE

- A. Quality Control Standard: Sheet Metal & Air Conditioning Contractor's National Association (SMACNA), latest edition, and the Florida Building Code.
- B. Installer Qualifications: Engage an experience Installer who has completed sheet metal flashing and trim work similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.
- C. Mockups: Prior to installing sheet metal flashing and trim, construct mockups indicated to verify selections made under Sample submittals and to demonstrate aesthetic effects as well as qualities of materials and execution. Build mockups to comply with the following requirements, using materials indicated for final unit of Work.
  - 1. Locate mockups on-site in the location and of the size indicated or, if not indicated, as directed by Architect.
  - 2. Notify Architect one week in advance of the dates and times when mockups will be constructed.
  - 3. Demonstrate the proposed range of aesthetic effects and workmanship.
  - 4. Obtain Architect's approval of mockups before start of final unit of Work.
  - 5. Retain and maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
    - a. When directed, demolish and remove mockups from Project site.
    - b. Approved mockups in an undisturbed condition at the time of Substantial Completion may become part of the completed Work.

1.6 WARRANTY: All warranted work under this section will be part of warranty coverage under sections 07616, 10520 and 13120

## 1.7 PROJECT CONDITIONS

- A. Coordinate Work of this Section with interfacing and adjoining Work for proper sequencing of each installation. Ensure best possible weather resistance, durability of Work, and protection of materials and finishes.

## PART 2 - PRODUCTS

### 2.1 ALUMINUM COPING:

- A. HICKMAN: Perma Snap 2 with product Florida Product approval # 7424

## 2.2 METALS

- A. Aluminum: Alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated and with not less than the strength and durability of alloy and temper designated below:
  - 1. Factory-Painted Aluminum Sheet: ASTM B 209, 3003-H14, with a minimum thickness of 0.040 inch, unless otherwise indicated.
  - 2. Extruded Aluminum: ASTM B 221, alloy 6063-T52, with a minimum thickness of 0.080 inch for primary legs of extrusions that are anodized, unless otherwise indicated.
- B. Stainless-Steel Sheet: ASTM A 167, Type 304, soft annealed, with No. 2D finish, except where harder temper is required for forming or performance; minimum 0.0187 inch thick, unless otherwise indicated.

## 2.3 MISCELLANEOUS MATERIALS AND ACCESSORIES

- A. Fasteners: Same metal as sheet metal flashing or other noncorrosive metal as recommended by sheet metal manufacturer. Match finish of exposed heads with material being fastened.
  - 1. Use S.S. 316 fasteners when connecting to P.T. Wood Nailers.
- B. Elastomeric Sealant: Generic type recommended by sheet metal manufacturer and fabricator of components being sealed and complying with requirements for joint sealants as specified in Division 7 Section "Joint Sealants."
- C. Self-Adhering Flashing/ Weather Barrier: Self-adhering rubberized asphalt membrane integrally bonded to polyethylene sheeting, formed into uniform flexible sheets of not less than 40 mils thick.
  - 1. Product and Manufacturer – Basis of Design: Perm-A-Barrier Wall Flashing; Grace Construction Products.
    - a. Surface Conditioner: Type as recommended by the manufacturer for substrates indicated.
- D. Metal Accessories: Provide sheet metal clips, straps, anchoring devices, and similar accessory units as required for installation of Work, matching or compatible with material being installed; noncorrosive; size and thickness required for performance.

## 2.4 FABRICATION, GENERAL

- A. Sheet Metal Fabrication Standard: Fabricate sheet metal flashing and trim to comply with recommendations of SMACNA's "Architectural Sheet Metal Manual" that apply to the design, dimensions, metal, and other characteristics of the item indicated.

- B. Comply with details shown to fabricate sheet metal flashing and trim that fit substrates and result in waterproof and weather-resistant performance once installed. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.
- C. Form exposed sheet metal Work that is without oil canning, buckling, and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems.
- D. Seams: Fabricate nonmoving seams in aluminum with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
- E. Expansion Provisions: Space movement joints at maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped or bayonet-type expansion provisions in Work cannot be used or would not be sufficiently weatherproof and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).
- F. Sealed Joints: Form nonexpansion, but movable, joints in metal to accommodate elastomeric sealant to comply with SMACNA standards.
- G. Separate metal from noncompatible metal or corrosive substrates with self-adhering flashing material.
- H. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of sheet metal exposed to public view.
- I. Fabricate cleats and attachment devices from same material as sheet metal component being anchored or from compatible, noncorrosive metal recommended by sheet metal manufacturer.
  - 1. Size: As recommended by SMACNA manual or sheet metal manufacturer for application but never less than thickness of metal being secured.

## 2.5 SHEET METAL FABRICATIONS

- A. General: Fabricate sheet metal items in thickness or weight needed to comply with performance requirements but not less than that listed below for each application and metal.
- B. Exposed Trim, Gravel Stops, and Fasciae: Fabricate from the following material:
  - 1. Aluminum: 0.050 inch thick.
- C. Copings: Fabricate from the following material:
  - 1. Aluminum: 0.050 inch thick.

- D. Base Flashing: Fabricate from the following material:
  - 1. Stainless Steel: 0.01inch minimum thickness.
- E. Counterflashing: Fabricate from the following material:
  - 1. Stainless Steel: 0.01inch minimum thickness.
- F. Flashing Receivers: Fabricate from the following material:
  - 1. Stainless Steel: 0.01inch minimum thickness.
- G. Equipment Support Flashing: Fabricate from the following material:
  - 1. Stainless Steel: 0.0187 inch thick.
- H. Concealed Flashing and Thru-Wall Flashing: Fabricate from the following material:
  - 1. Stainless Steel: 0.0187 inch thick; mill finish.

## 2.6 ALUMINUM FINISHES

- A. General: Comply with Aluminum Association's (AA) "Designation System for Aluminum Finishes" for finish designations and application recommendations.
- B. High-Performance Organic Finish: AA-C12C42R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: acid-chromate-fluoride-phosphate conversion coating; Organic Coating: as specified below). Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
  - 1. Fluoropolymer Two-Coat System: Manufacturer's standard two-coat, thermocured system consisting of specially formulated inhibitive primer and fluoropolymer color topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight; complying with AAMA standards.
    - a. Colors: Custom to be selected by the Architect to match existing building coping..

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates and conditions under which sheet metal flashing and trim are to be installed and verify that Work may properly commence. Do not proceed with installation until unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. General: Unless otherwise indicated, install sheet metal flashing and trim to comply with performance requirements, manufacturer's installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Anchor units of Work securely in place by methods indicated, providing for thermal expansion of metal units; conceal fasteners where possible, and set units true to line and level as indicated. Install Work with laps, joints, and seams that will be permanently watertight and weatherproof.
  - 1. Install exposed sheet metal Work that is without oil canning, buckling, and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to result in waterproof and weather-resistant performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.
- B. Expansion Provisions: Provide for thermal expansion of exposed sheet metal Work. Space movement joints at maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped or bayonet-type expansion provisions in Work cannot be used or would not be sufficiently weatherproof and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).
- C. Sealed Joints: Form nonexpansion, but movable, joints in metal to accommodate elastomeric sealant to comply with SMACNA standards. Fill joint with sealant and form metal to completely conceal sealant.
  - 1. Use joint adhesive for nonmoving joints specified not to be soldered.
- D. Seams: Fabricate nonmoving seams in aluminum with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
- E. Separations: Separate metal from noncompatible metal or corrosive substrates using self-adhering flashing material.
- F. Counterflashings: Coordinate installation of counterflashings with installation of assemblies to be protected by counterflashing. Install counterflashings in reglets or receivers. Secure in a waterproof manner by means of snap-in installation and sealant, lead wedges and sealant, interlocking folded seam, or blind rivets and sealant. Lap counterflashing joints a minimum of 2 inches and bed with sealant.
- G. Equipment Support Flashing: Coordinate equipment support flashing installation with roofing and equipment installation. Seal flashing to equipment support member.

### 3.3 CLEANING AND PROTECTION

- A. Clean exposed metal surfaces, removing substances that might cause corrosion of metal or deterioration of finishes.

- B. Provide final protection and maintain conditions that ensure sheet metal flashing and trim Work during construction is without damage or deterioration other than natural weathering at the time of Substantial Completion.

END OF SECTION 07620





### PART 3 - EXECUTION

#### 3.01 INSTALLATION

- A. Secure each panel at each groove and at clip joint of the panel. All joints shall be mechanically fastened to prevent disengagement of joint. Installation and fastener spacing to comply with wind loads on structural drawings and Florida Product Approval requirements.

#### 3.02 WORKMANSHIP AND INSTALLATION:

- A. Before starting work, verify governing dimensions at building; examine clean, repair, if necessary, any adjoining work on which this work in any way is dependent for its proper installation.
- B. Install in accordance with manufacturer's installation instructions. soffit , fascia accessory trim and fasteners shall be from a single manufacturer.

#### 3.03 FINAL CLEANING:

- A. Upon completion of the new soffit/ceiling and fascia work shall be cleaned with a damp cloth to remove any surface dirt or fingerprints.

#### 3.04 DISSIMILAR MATERIALS:

- A. Aluminum shall not be installed in contact with dissimilar metals, concrete, stucco, masonry or corrosive non-metallic materials which become repeatedly wet condition. Do not permit water from copper flashing to drain over aluminum products.

END SECTION - 07622

## **SECTION 07920 - JOINT SEALANTS**

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. This Section includes sealants for the following applications, including those specified by reference to this Section:

1. Exterior joints in the following vertical surfaces and nontraffic horizontal surfaces:
  - a. Control and expansion joints in cast-in-place concrete.
  - b. Control and expansion joints in unit masonry.
  - c. Joints between different materials listed above.
  - d. Perimeter joints between materials listed above and frames of doors and windows.
  - e. Other joints as indicated.
2. Exterior joints in the following horizontal traffic surfaces:
  - a. Control, expansion, and isolation joints in cast-in-place concrete slabs.
  - b. Tile control and expansion joints.
  - c. Joints between different materials listed above.
  - d. Other joints as indicated.
3. Interior joints in the following vertical surfaces and horizontal nontraffic surfaces:
  - a. Control and expansion joints on exposed interior surfaces of exterior walls.
  - b. Perimeter joints of exterior openings where indicated.
  - c. Tile control and expansion joints.
  - d. Vertical control joints on exposed surfaces of interior unit masonry and concrete walls and partitions.

- e. Perimeter joints between interior wall surfaces and frames of interior doors, windows, and elevator entrances.
  - f. Joints between plumbing fixtures and adjoining walls, floors, and counters.
  - g. Other joints as indicated.
4. Interior joints in the following horizontal traffic surfaces:
- a. Control and expansion joints in cast-in-place concrete slabs.
  - b. Control and expansion joints in tile flooring.
  - c. Other joints as indicated.

### 1.3 PERFORMANCE REQUIREMENTS

- A. Provide elastomeric joint sealants that establish and maintain watertight and airtight continuous joint seals without staining or deteriorating joint substrates.
- B. Provide joint sealants for interior applications that establish and maintain airtight and water-resistant continuous joint seals without staining or deteriorating joint substrates.

### 1.4 SUBMITTALS

- A. Product Data: For each joint-sealant product indicated.
- B. Samples for Initial Selection: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.

### 1.5 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer who has specialized in installing joint sealants similar in material, design, and extent to those indicated for this Project and whose work has resulted in joint-sealant installations with a record of successful in-service performance.
- B. Source Limitations: Obtain each type of joint sealant through one source from a single manufacturer.

### 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to Project site in original unopened containers or bundles with labels indicating manufacturer, product name and designation, color, expiration date, pot life, curing time, and mixing instructions for multicomponent materials.

- B. Store and handle materials in compliance with manufacturers written instructions to prevent their deterioration or damage due to moisture, high or low temperatures, contaminants, or other causes.
- C. Preinstallation Conf: Include, manufacturer, installer, general contracting OAR and architect to review product, installation and warranty requirements.

#### 1.7 PROJECT CONDITIONS

- A. Environmental Limitations: Do not proceed with installation of joint sealants under the following conditions:
  - 1. When ambient and substrate temperature conditions are outside limits permitted by joint sealant manufacturer.
  - 2. When ambient and substrate temperature conditions are outside limits permitted by joint sealant manufacturer or are below 40 degrees F.
  - 3. When joint substrates are wet.
- B. Joint-Width Conditions: Do not proceed with installation of joint sealants where joint widths are less than those allowed by joint sealant manufacturer for applications indicated.
- C. Joint-Substrate Conditions: Do not proceed with installation of joint sealants until contaminants capable of interfering with adhesion are removed from joint substrates.

#### 1.8 WARRANTY

- A. General Warranty: Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.
- B. Special Manufacturer's Warranty: Written warranty, signed by elastomeric sealant manufacturer agreeing to furnish elastomeric joint sealants to repair or replace those that do not comply with performance and other requirements specified in this Section within specified warranty period.
  - 1. Warranty Period: As specified, beginning from date of Substantial Completion.

### PART 2 - PRODUCTS

#### 2.1 PRODUCTS AND MANUFACTURERS

- A. Products: Subject to compliance with requirements, provide the following products indicated for each type in the sealant.

1. One-Part Silicone Sealant: For poured-in-place concrete and concrete-to-masonry; one-part silicone sealant, having a joint movement capability of plus-or-minus 100% elongation, minus 50% compression, and Shore A durometer hardness of 15.
  - a. Product and Manufacturer: "No. 790"; Dow Corning Corp. or equal product as manufactured by General Electric Co.
  - b. Warranty: Manufacturer's standard 20 year warranty.
2. One-Part Silicone Sealant: For masonry-to-aluminum, steel-to-aluminum, concrete-to-aluminum, steel-to-steel, and other metal-to-metal joints (including KYNAR coatings); one-part silicone sealant having a joint movement capability of plus-or-minus 50% elongation, and Shore A durometer hardness of 30.
  - a. Products and Manufacturers: Provide one of the following.
    - 1) "Dow Corning 795"; Dow Corning Corp.
    - 2) "Silpruf SCS 2000"; General Electric Co.
  - b. Warranty: Manufacturer's 5 year warranty.
3. Two-Part, Pourable Urethane Sealant: For horizontal joints, exterior and interior; provide joint sealant with a joint movement capability of plus-or-minus 25%.
  - a. Products and Manufacturers: Provide one of the following.
    - 1) "Vulkem 245"; Tremco, Inc.
    - 2) "NR200 Urexpan"; Pecora Corp.
    - 3) "Sikaflex 2c SL"; Sika Corp.
    - 4) "THC-900"; Tremco, Inc.
  - b. Warranty: Manufacturer's extended 5 year warranty.
4. Two-Part Urethane Non-Sag Sealant: For general interior use; provide joint sealant with a joint movement capability of plus-or-minus 50%.
  - a. Products and Manufacturers: Provide one of the following:
    - 1) "Vulkem 922"; Tremco, Inc.
    - 2) "Dynatrol II"; Pecora Corp.
    - 3) "Sikaflex 2c NS"; Sika Corp.

- 4) "NP II"; Sonneborne Building Products Division, ChemRex, Inc.
- b. Warranty: Manufacturer's extended 5 year warranty.
5. One-Part Silicone - Sanitary Sealant: For Interior use at plumbing fixtures in toilets and janitor closets, and horizontal and vertical joints of dissimilar materials in toilets and other wet areas.
  - a. Products and Manufacturers: Provide one of the following.
    - 1) "786"; Dow Corning Corp.
    - 2) "SCS 1700"; General Electric Co.
    - 3) "898"; Pecora Corp.
    - 4) "600"; Tremco, Inc.
  - b. Warranty: Manufacturer's extended 3 year warranty.
6. One-Part Latex Sealant: For interior use for horizontal and vertical joints around door frames, and joints between dissimilar materials.
  - a. Products and Manufacturers: Provide one of the following.
    - 1) "AC-20"; Pecora Corp.
    - 2) "Sonolac"; Sonneborn Building Products Div., ChemRex, Inc.
    - 3) "Tremco Acrylic Latex 834"; Tremco, Inc.
  - b. Warranty: Manufacturer's standard warranty.

## 2.2 MATERIALS, GENERAL

- A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
- B. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range for this characteristic.

## 2.3 JOINT-SEALANT BACKING

- A. General: Provide sealant backings of material and type that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

- B. Backer Rod (Joint Fillers, Compressible Filler): Preformed, compressible, resilient, non-staining, reticulated, closed-cell polymeric foam, nonoutgassing, with a density of 2.5 pcf and tensile strength of 35 psi per ASTM D 1623, and with water absorption less than 0.02 g/cc per ASTM C 1083.
  - 1. Available Products: Subject to compliance with requirements, materials that may be incorporated into the Work include, but are not limited to the following:
    - a. Product and Manufacturer - Basis of Design: Sof Rod; Nomaco, Inc., Zebulon, NC.
- C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint where such adhesion would result in sealant failure. Provide self-adhesive tape where applicable.

#### 2.4 MISCELLANEOUS MATERIALS

- A. Primer: Material recommended by joint sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.
- B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants with joint substrates.
- C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

#### 3.2 PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint sealant manufacturer's written instructions.

- B. Joint Priming: Prime joint substrates, unless otherwise recommended in writing by joint sealant manufacturer, based on preconstruction joint-sealant-substrate tests or prior experience.
  - 1. Apply primer to comply with joint sealant manufacturer's written instructions. 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 INSTALLATION OF JOINT SEALANTS

- A. General: Comply with joint sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.
  - 1. Install sealants by proven techniques and at the same time backings are installed.
  - 2. Place sealants so they directly contact and fully wet joint substrates.
  - 3. Completely fill recesses provided for each joint configuration.
  - 4. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.
- B. Backing Materials: Install sealant backings of type indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
  - 1. Do not leave gaps between ends of sealant backings.
  - 2. Do not stretch, twist, puncture, or tear sealant backings.
  - 3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.
- C. Bond-Breaker Tape: Install bond-breaker tape behind sealants where sealant backings are not used between sealants and back of joints.
- D. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
  - 1. Remove excess sealants from surfaces adjacent to joint.



2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
3. Provide concave joint configuration per Figure 5A in ASTM C 1193, unless otherwise indicated.

### 3.4 FIELD QUALITY CONTROL

- A. Field-Adhesion Testing: Perform field-test joint-sealant adhesion to joint substrates as follows:
  1. Extent of Testing: Test completed elastomeric sealant joints as follows:
    - a. Perform 10 tests for the first 1000 feet of joint length for each type of elastomeric sealant and joint substrate.
    - b. Perform one test for each 1000 feet of joint length thereafter or one test per each floor per elevation.
  2. Test Method: Test joint sealants by hand-pull method described below:
    - a. Make knife cuts from one side of joint to the other, followed by two cuts approximately 2 inches long at sides of joint and meeting cross cut at one end. Place a mark 1 inch from cross-cut end of 2-inch piece.
    - b. Use fingers to grasp 2-inch piece of sealant between cross-cut end and 1-inch mark; pull firmly at a 90-degree angle or more in direction of side cuts while holding a ruler along side of sealant. Pull sealant out of joint to the distance recommended by sealant manufacturer for testing adhesive capability, but not less than that equaling specified maximum movement capability in extension; hold this position for 10 seconds.
    - c. For joints with dissimilar substrates, check adhesion to each substrate separately. Do this by extending cut along one side, checking adhesion to opposite side, and then repeating this procedure for opposite side.
  3. Inspect joints for complete fill, for absence of voids, and for joint configuration complying with specified requirements. Record results in a field adhesion test log.
  4. Inspect tested joints and report on the following:
    - a. Whether sealants in joints connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each type of product and joint substrate. Compare these results to determine if adhesion passes sealant manufacturer's field- adhesion hand-pull test criteria.
    - b. Whether sealants filled joint cavities and are free from voids.

- c. Whether sealant dimensions and configurations comply with specified requirements.
  5. Record test results in a field adhesion test log. Include dates when sealants were installed, names of persons who installed sealants, test dates, test locations, whether joints were primed, adhesion results and percent elongations, sealant fill, sealant configuration, and sealant dimensions.
  6. Repair sealants pulled from test area by applying new sealants following same procedures used to originally seal joints. Ensure that original sealant surfaces are clean and new sealant contacts original sealant.
- B. Evaluation of Field-Test Results: Sealants not evidencing adhesive failure from testing or noncompliance with other indicated requirements, will be considered satisfactory. Remove sealants that fail to adhere to joint substrates during testing or to comply with other requirements. Retest failed applications until test results prove sealants comply with indicated requirements.

### 3.5 CLEANING

- A. Clean off excess sealants or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

### 3.6 PROTECTION

- A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants 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 installations with repaired areas are indistinguishable from the original work.

END OF SECTION 07920

## **SECTION 08100 - STEEL DOORS AND FRAMES**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

- A. The General Provisions of the Contract, including General and Supplementary Conditions and General Requirements apply to the work specified in this section.

#### **1.2 DESCRIPTION OF WORK**

- A. The extent of standard steel doors and frames as shown on drawings and schedules.
- B. The extent of hollow metal windows shown on the drawing.
- C. All work under this section includes the furnishing of assemblies which comply with the Miami-Dade county product control approval system or the Florida Building code approval system for all exterior doors.

#### **1.3 QUALITY ASSURANCE**

- A. Provide standard steel doors and frames manufactured by a single firm specializing in production of this type of work, unless otherwise acceptable to Architect.
- B. Fabricate side panels and transom panels to match doors in all respects unless otherwise indicated.

#### **1.4 REFERENCES**

- A. Steel doors and frames in this section shall meet the following standards:  
American Society for Testing and Materials
  - 1. A653 Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot-Dip process.
  - 2. A924 Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot Dip Process.
- C. American National Standards Institute
  - 1. ANSI/UL 10C Positive Pressure Fire Tests of Door Assemblies
  - 2. ANSI/NFPA 80 Fire Doors and Fire Windows
  - 3. ANSI A250.4 Test Procedures and Acceptance Criteria for Physical Endurance for Steel Doors, Frames, Frame Anchors, and Hardware Reinforcing
  - 4. ANSI A250.6 Hardware on Standard Steel Doors
  - 5. ANSI A250.7 Nomenclature for Steel Doors and Steel Door

Frames

6. ANSI A250.10 Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames

D. Door and Hardware Institute

1. DHI 115.1G Installation Guide for Doors and Hardware

1.5 SUBMITTALS

- A. See Section 01300 "Submittals"
- B. Product Data - Standard Steel Doors and Frames: Submit 6 copies manufacturer's product data for fabrication and installation instructions.
- C. Shop Drawings - Standard Steel Doors and Frames: Submit 6 copies shop drawings for fabrication and installation of steel doors and frames. Include details of each frame type, elevations of door design types, conditions at openings, details of construction, location and installation requirements of finish hardware and reinforcements, and details of joints and connections. Show anchorage and accessory items.
- D. Provide schedule of doors and frames using same reference numbers for details and openings as those on contract drawings.
- E. Provide copies of Testing Certificate for compliance with code approvals.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Deliver hollow metal work cartoned or crated to provide protection during transit and job storage.
- B. Inspect hollow metal work upon delivery for damage. Minor damages may be repaired provided finish items are equal in all respects to new work and acceptable to Architect; otherwise, remove and replace damaged items as directed.
- C. Store doors and frames at building site under cover. Place units on at least 4" high wood sills or on the floors in a manner that will prevent rust and damage. Avoid use of non-vented plastic or canvas shelters, which could create a humidity chamber. If cardboard wrapper on door becomes wet, remove carton immediately. Provide a 1/4" space between stacked doors to promote air circulation.

PART 2 – PRODUCTS

## 2.0 PRODUCTS

A. Provide standard steel doors and frames as manufactured by one of the following:

1. Ceco Corp.
2. Steelcraft Mfg. Co. or approved equal

B. Fire-Rated Assemblies:

1. Where fire-resistance classification is shown or scheduled for steel doors and frames, provide fire-rated doors investigated and tested as a fire door assembly, complete with type of hardware to be used. Identify each fire door with recognized testing laboratory labels, indicating applicable fire rating of steel doors.
2. Construct and install assemblies to comply with N.F.P.A. Standard No. 80, and as herein specified.

C. Wind Rated Assemblies:

1. Where wind rated assemblies are shown or scheduled for steel doors, frames, and steel window frames provide product investigated and tested as a certified wind assembly.
2. Construct and install assemblies to comply with Miami-Dade County Product Control Approval System or the Florida Building Code Approval System. Door assemblies shall resist the cyclic pressures, static pressures, and missile impact loads as detailed in Florida Building Code test protocols TAS 201, TAS 202, and TAS 203.
3. Description of basis of design, Imperial Series 8070/4070 Outswing Commercial Steel Door. NO No 09-0505.09. Or approved equal.

## 2.1 HARDWARE LOCATIONS AND REINFORCEMENTS

A. Hardware locations on doors and frames shall be in accordance with the manufacturer's standard locations

B. Doors shall be mortised, reinforced, and function holes prepared in accordance with the specified hardware. Through bolt holes, attachment holes, or drilling and tapping for surface hardware shall be done by others.

## 2.2 MATERIAL

- A. Doors, frames, and frame components shall be manufactured from hot-dipped galvanized steel having an A60 zinc-iron alloy coating conforming to ASTM designations A653 and A924.
- B. All doors and frames shall be cleaned, phosphatized, and finished as standard with one coat of baked on rust inhibiting prime paint in accordance with ANSI A250.10

## 2.3 STEEL DOORS

### A. Materials

1. Face sheets shall be 14 gage hot-dipped galvanized steel having an A60 zinc-iron coating conforming to ASTM designations A653 and A924.
2. Doors shall have continuous vertical mechanical interlocking joints at lock and hinge edges with edge seams (exposed) (filled and ground smooth) (welded, filled and ground smooth).
3. Doors shall have hinge and lock edges beveled 1/8" in 2".
4. Top and bottom steel reinforcement channels shall be galvanized 14 gage, projection welded to both face sheets on 4" centers.
5. Hinge reinforcements shall be 7 gage galvanized steel, projection welded to the edge of the door.
6. Door faces shall be reinforced and sound deadened by rigid polystyrene core laminated to the inside faces of both panels.

## 2.4 STEEL FRAMES

### A. Materials

1. Frames shall be fabricated from 16 gage hot-dipped galvanized steel having an A60 zinc-iron alloy coating conforming to ASTM designations A653 and A924.
2. Hinge and strike jambs shall have 2" faces, heads shall be 2", 4" face as shown on the drawings.
3. Corner connections shall be set up and arc welded, ground, dressed smooth, and painted.
4. Hinge reinforcements shall be 7 gage galvanized steel prepared for 4 1/2" by 4 1/2", standard weight.

### B. Fabrication

1. Provide steel frames to the size and design as shown on the architectural drawings.
2. Frames shall be mortised, reinforced, drilled, and tapped at the factory for template hardware only. Where surface mounted hardware is to be applied, frames shall have reinforcing plates only, all drilling and

tapping to be done by others.

### C. Anchors

1. Anchors for masonry walls shall be masonry wire type. Quality of anchors installed as required for system performance.
2. Steel plaster guards shall be provided for all mortised cut-outs.
3. All welded frames shall be provided with a temporary steel spreader bar for shipping and handling only. This temporary spreader shall be removed and a setting spreader, supplied by the installer, shall be used for installation of the frame.

## 2.5 LABELED DOORS AND FRAMES

- A. All doors and frames, when specified, shall be listed and labeled in accordance with Underwriters Laboratories standard UL10C, Positive Pressure Fire Tests of Door Assemblies and Uniform Building Code Standard 7-2, Fire Tests of Door Assemblies.
- B. Construct and install doors and frames to comply with current issue of National Fire Protection Association (NFPA) standard number 80, as herein specified.
- C. Doors and/or frames for fire labeled openings shall bear an applied label from Underwriters Laboratory.
- D. Door assemblies shall bear a label indicating compliance with the applicable labeling requirements of the Florida Building Code.

## 2.6 PRIME FINISH

- A. Doors and frames are to be cleaned and chemically treated to ensure maximum finish paint adhesion. All surfaces of the door and frame exposed to view shall receive a factory applied coat of rust inhibiting primer. The finish shall meet requirements for acceptance stated in ANSI A250.10 "Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames."

## 2.8 FABRICATION - GENERAL

- A. Fabricate steel door and frame units to be rigid, neat in appearance and free from defects, warp or buckle. Wherever practicable, fit and assemble units in manufacturer's plant. Clearly identify work that cannot be permanently factory-assembled before shipment, to assure proper assembly at project site.
- B. Fabricate exposed faces of doors and panels, including stiles and rails of non-flush units, from only cold-rolled steel.
- C. Fabricate frames, concealed stiffeners, reinforcement, edge channels,

louvers and moldings from either cold-rolled or hot-rolled steel.

- D. Fabricate all interior and exterior doors, panels and frames from galvanized sheet steel.
- E. Exposed Fasteners: Unless otherwise indicated, provide countersunk flat Phillips heads for exposed screws and bolts.
- F. Finish Hardware Preparation: Prepare hollow metal units to receive finish hardware, including cutouts, reinforcing, drilling and tapping in accordance with final Finish Hardware Schedule and templates provided by hardware supplier.
- G. Reinforce hollow metal units to receive surface- applied hardware.

## 2.7 GLASS:

- A. Provide in all door vision panels, fixed glass windows with hollow metal frames, hollow metal frame transoms as shown on drawings with 9/16" Oldcastle Laminate- 1/4" PPG Solarbronze-0.060" Clear PVB- 1/4" Clear. Or approved equal.

## PART 3 - EXECUTION

### 3.1 INSPECTION

- A. Installer must examine substrate and conditions under which steel doors and frames are to be installed and notify the Contractor in writing of any conditions detrimental to proper and timely completion of work. Do not proceed with work until unsatisfactory conditions have been corrected in a manner acceptable to Installer.

### 3.2 INSTALLATION

- A. General:
- B. Install hollow metal units and accessories in accordance with final shop drawings and manufacturer's data, and as herein specified.
- C. Placing Frames: DHI 115.1G Installation Guide for Doors and Hardware shall indicate the proper installation procedures.
- D. Except for frames located at in-place concrete or masonry and at drywall installation, place frames prior to construction of enclosing walls and ceilings. Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is completed,



- remove temporary braces and spreaders leaving surfaces smooth and undamaged.
- E. In masonry construction locate 6 wall anchors per jamb at hinge and strike levels. Building-in of anchors and grouting of frames is specified in the Section 04220.
  - F. At in-place concrete or masonry construction, set frames and secure to adjacent construction with masonry anchorage devices.
  - G. Install fire-rate frames in accordance with N.F.P.A. Standard No. 80.
  - H. In metal stud partitions, install at least 6 wall anchors per jamb at hinge and strike levels. In open steel stud partitions, place studs in wall anchor notches and wire tie. In closed steel stud partitions, attach studs to wall anchors with tapping screws.
  - I. Door Installation: Proper door clearance must be maintained in accordance with DHI 115.1G. Install doors plumb and in true alignment and fasten to achieve the maximum operational effectiveness and appearance of the unit. Maintain clearances specified. Shim as indicated in DHI A115.1G.
  - J. Place fire-rated doors with clearances as specified in N.F.P.A. Standard No. 80.
  - K. Finish hardware is specified in Section 08700 "Finished Hardware".

### 3.3 ADJUST AND CLEAN

- A. Fastener Filling: Fill heads of exposed fasteners with surface filler, allow to harden and grind smooth.
- B. Final Adjustments: Check and readjust operating finish hardware items in hollow metal work prior to final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including doors and frames that are warped, bowed or otherwise damaged.
- C. 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.
- D. Damaged frames: Frames damaged during installation shall be replaced with frames that are true and square.

END SECTION 08100

## **SECTION 08300 - OVERHEAD ROLLING METAL DOOR**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

- A. The General Conditions of the Contract, including the General Requirements of Division 1, apply to the work of this Section.

#### **1.2 DESCRIPTION OF WORK**

- A. The work under this Section of the specifications includes all labor, materials, equipment and services necessary to complete the overhead rolling door work as shown on the drawings and herein specified.
- B. Provide complete operating door assemblies including door, curtains, guides, counterbalance mechanism, operators and installation accessories, as shown on the drawings and herein specified.
- C. The following types of rolling doors are specified in this section:
  - 1. Steel rolling door with electrical motor and 3 button controller.

#### **1.3 QUALITY ASSURANCE**

- A. Furnish each rolling service door as a complete unit produced by one manufacturer, including hardware, accessories, mounting and installation components.
- B. Furnish all rolling door units by one manufacturer for the entire project.
- C. Manufacturer: Provide rolling doors as manufactured by one of the following:
  - 1. Atlas Steel Products Co.
  - 2. Cornell Iron Works Inc.
  - 3. Kinnear Div., Harsco Corp.
  - 4. North American Rolling Door, Inc.
- D. Insert and Anchorages: Furnish inserts and anchoring devices which must be set in concrete or built into masonry for the installation of the units. Provide setting drawings, templates, instructions and directions for installation of anchorage devices. Coordinate delivery with other work to avoid delay.
- E. See concrete and masonry sections of these specifications for installation of inserts and anchorage device.

- F. Wind Loading: Design and reinforce rolling doors to withstand a wind loading pressure with a maximum deflection of 1/120 of opening width, as follows:
1. Wind loading Pressure: See Structural Drawings for wind speed and wind loads.

#### 1.4 SUBMITTALS

- A. Submit manufacturer's product data, roughing-in diagrams, and installation instructions for each type and size of rolling door. Include operating instructions and maintenance information data. Transmit a copy of diagrams and installation instructions to installer.
- B. Submit shop drawings for special components and installations, which are not fully dimensioned or detailed on manufacturers data sheets.
- C. Provide an additional eleven (11) sets of signed, sealed drawings and calculations of the door wind load design pressure as required by Orange County Ordinance and Florida Building Code Approval System. The drawing shall be prepared by a Florida Registered Engineer.

### PART 2 - PRODUCTS

#### 2.1 MATERIALS

- A. Insulated Steel Rolling Door: Similar to Model #T-3, 23, PS, motor operation, Atlas insulated door, or accepted equal. See Door Schedule on drawings.
  1. Curtain: Galvanized steel flat slats both faces, insulated core. Baked coat of primer paint.
  2. Thermal Break: 3/16" thermal break at top and bottom of each slat, where slats interlock and curve around each other. Guide weather seal.
  3. Brackets: Steel plate and support the hood, barrel and counter balance on ball bearings. Galvanized steel.
  4. Hood: Galvanized steel 24 ga.
  5. Weather-stripping: Full-door width, flexible seal attached to lintel and seal against curtain. Full door height P.V.C. seal on each guide contacting the exterior flat curtain surfaces.
  6. Guide Assemblies: Structural steel angles including wind bars, galvanized steel.

7. Primer: All ferrous surfaces (other than moving machinery parts, galvanized surfaces and stainless steel) to receive a factory, 3-coat epoxy primer.
8. Bottom Seal: Astragal.
9. Counterbalancing Mechanism: Counterbalance doors as by means of an adjustment steel helical torsion spring, mounted around a steel shaft and mounted in a spring barrel and connected to the door curtain with the required barrel rings, Use grease-sealed bearings or self-lubricating graphite bearings for rotating members.
10. Counterbalance Barrel: Fabricate spring barrel of hot-formed structural quality carbon steel, welded or seamless pipe, of sufficient diameter and wall thickness to support the roll-up of curtain without distortion of slat and limit barrel deflection to not more than 0.03" per ft. of span under full load.
11. Provide spring balance of one or more oil-tempered, heat-treated steel helical torsion springs. Size springs to counterbalance the weight of the curtain, with uniform adjustment accessible from outside barrel. Provide cast steel barrel plugs to secure ends of springs to the barrel and the shaft.
12. Fabricate torsion rod for counterbalance shaft of casehardened steel, of required size to hold the fixed spring ends and carry the torsional load.
13. Mounting: As required for proper operation and clearance with structural components of the building.
14. Painting: Shop clean and prime ferrous metal and galvanized surfaces, exposed and unexposed, except faying and lubricated surfaces, with door manufacturer's standard rust inhibitive primer drying to a flat sheen.
15. Electrical Operation: Heavy duty, belt drive operator motor by manufacturer of the door. 1 H.P., 120 volts, 25 cycle/day.
16. Push-button Control Station: Open/close with emergency stop.
17. Bottom Door Safety Edge: Edge will reverse the door device if an obstruction is detected. Featheredge System by Coorson Co.

### PART 3 - EXECUTION

### 3.1 GENERAL

- A. Inspection: Inspect all openings to receive doors. Do not start installation until unsatisfactory conditions have been corrected.
- B. Installation: Doors shall be mounted as indicated on drawings.
- C. Install door and operating equipment complete with necessary hardware, jamb and head mold strips, anchors, inserts, hangers, and equipment supports in accordance with manufacturer's instructions and as specified herein.
- D. Doors and shutters shall be installed with horizontal line level and guides shall be installed vertical and plumb.
- E. Doors and shutters operation mechanism shall be made operative at completion of the installation.
- F. Doors and shutters are to be erected by the manufacturer, his agent or authorized representative.
- G. Adjust and Clean: Adjust all workable hardware installation of door assemblies.
- H. Upon completion of installation including work by other trades, lubricate, test and adjust doors to operate easily, free from warp, twist or distortion and fitting watertight and sound tight for the entire perimeter.
- I. Coordinate with electrical divisions for connection/location of electrical motor and push-button controller.

END SECTION 08300

## **SECTION 08305 – ACCESS DOORS**

### **PART 1 - GENERAL**

#### **1.0 RELATED DOCUMENTS**

- A. The general provisions of the Contract, including the General and Supplementary Conditions and General Requirements (if any) apply to the work specified in this section.

#### **1.1 DESCRIPTION OF WORK**

- A. The extent, location and size of each type of door required by code, shown on the drawings and specified herein.
- B. Provide all access door required by code to access mechanical, electrical and fire protection items in concealed spaces such as but not limited in hard ceilings, partition walls, masonry wall, through the project.

#### **1.2 RELATED WORK SPECIFIED ELSEWHERE**

- A. Gypsum Drywall Section 09250
- B. Mechanical Division 15.
- C. Electrical Division 16.

#### **1.3 QUALITY ASSURANCE**

- A. Fire-Resistance Ratings: Wherever a fire-resistance classification as required by location of access panel in a rated assembly, provide access door assembly with panel door, frame, hinge, and latch from manufacturer listed in Underwriters' Laboratories, Inc.: "Classified Building Materials Index" for the rating required..
  - 1. Provide UL label on each fire-rated access panels.
  - 2. Furnish with flush, key operated cylinder core.

#### **1.4 SIZE VARIATIONS**

- A. Size of door to meet the Florida Building Code to allow access and for maintenance to plumbing valves/backflow preventer, mechanical equipment and electrical/ communication junction boxes.

- B. If no minimum is established by code use the following as a basis.
  - 1. Manufacturers recommendation access for maintenance of equipment
  - 2. Wall access 18" x 18"
  - 3. Ceiling Access 24" x 24"
- 1.5 MANUFACTURERS OFFERING PRODUCTS to comply with the requirements for steel access panels and frames include the following:
- 1.6 MANUFACTURER: Provide access doors as manufactured by one of the following:
  - A. Acudor
  - B. Milcor Div-Inryco, Inc.
  - C. Larsens manufacturing
  - D. Or accepted equal
- 1.7 Inserts and Anchorages:
  - A. Furnish inserts and anchoring devices which must be built into other work for the installation of access doors. Coordinate delivery with other work to avoid delay.
  - B. Coordinate with other trades requiring access to their installed item for size requirements.
- 1.8 SUBMITTALS
  - A. Manufacturer's /Data; Access Doors
    - 1. For information only, submit 6 copies of manufacturer's technical data and installation instructions for each type of access door assembly. Transmit copy of each instruction to the Installer.
    - 2. Provide setting drawings, templates, instructions and directions for installation of anchorage devices.

## PART 2 – PRODUCTS

### 2.0 MATERIALS AND FABRICATION

- A. General: Furnish access door assemblies manufactured as an integral unit, complete with all parts and ready for installation.

- B. Steel access doors and Frames fabricate units of continuous welded steel construction, unless otherwise indicated. Grind welds smooth and flush with adjacent surfaces. Furnish attachment devices and fasteners of the type required to secure access panels to the types of support shown.
- C. Frames fabricate from 14 gauge stainless steel.
  - 1. Fabricate frame with exposed flange approximately 1" wide around perimeter of frame for units installed in the following construction:
    - a. Drywall finish
- D. Flush Panel Doors fabricate from not less than 14 gage stainless steel, with concealed spring hinges set to open to 175 degrees. Finish with factory stainless steel finish.
  - 1. Provide flush panel doors, unless otherwise indicated.
    - a. For fire rated units, provide manufacturer's standard insulated flush panel doors.
- E. Locking Devices:
  - 1. Provide one cylinder lock per access door. Furnish 2 keys per lock and key all locks alike, unless otherwise scheduled.

## PART 3 – EXECUTION

### 3.0 INSPECTION

- A. Installer must examine the areas and conditions under which access doors are to be installed and notify the Contractor in writing of conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to the Installer.

### 3.1 INSTALLATION

- A. Comply with manufacturer's instructions for installation of access doors.
- B. Coordinate installation with work of other trades.
- C. Provide building-in anchors of position and grouting of frames for installation in Division 4 sections of these specifications.
- D. Set frames accurately in position and securely attach to support with face



- panels plumb. or level in relation to adjacent finish surfaces.
- E. Adjust hardware and panels after installation for proper operation.
  - F. Remove and replace panels or frames which are warped, bowed or otherwise damaged.
  - G. Provide protection of surface of access panel and remove after all adjacent painted surfaces have been completed.

END SECTION 08305

## **SECTION 08410 ALUMINUM STOREFRONTS**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

- A. Drawings and General Provisions of Contract, including General and Supplementary Conditions and Division 1 - Specification Sections apply to work of this section.
- B. Section 03300 – Structural Concrete.
- C. Section 04220 – Concrete Unit Masonry Work.
- D. Section 08800 – Glass and Glazing.

#### **1.2 QUALITY ASSURANCE**

- A. Provide aluminum entrances, storefront framing and curtain wall system by manufacturer(s) upon which drawings are based or by one of the following or approved equal:
  - 1. Oldcastle Building Envelope  
803 Airport Road  
Terrell, TX 75160
  - 2. Or approved equal
- B. All frames shall be reinforced and fastened to meet wind loads as noted on structural drawing for wind pressure.
- C. System shall have NOA approval for system.

#### **1.3 REFERENCES**

- A. Aluminum association (AA)
  - 1. DAF-45 Designation System for Aluminum Finishes
- B. American Architectural Manufacturers Association (AAMA)
  - 1. 501.2 - Field Check of Metal Curtain Wall for Water Leakage
  - 2. 2605- Voluntary Specification for High Performance Organic Coatings on Architectural Extrusions and Panels.
  - 3. 606.1- Specifications and Inspection Methods for Integral Color Anodic

Finishes for Architectural Aluminum.

4. 607.1- Specifications and Inspection Methods for Clear Anodic Finishes for Architectural Aluminum.
5. 608.1- Specifications and Inspection Methods for Electrolytically deposited Color Anodic Finishes for Architectural Aluminum.
6. 701.2- Specifications for Pile Weather Stripping
7. Manual # 10- Care and Handling of Architectural Aluminum from Shop to Site.
8. SFM-1 –Aluminum Storefront and Entrance Manual

C. American National Standards Institute (ANSI)

1. A117.1 Safety Standards for the Handicapped
2. Z97.1- Safety Glazing Materials Used In Buildings- Safety Performance Specifications and Methods of Test

D. American Society for Testing and Materials

1. A36- Structural Steel
2. A123- Zinc ( Hot Dip Galvanized) Coatings on Iron and Steel Products
3. B209- Aluminum and Aluminum- Alloy Sheet and Plate
4. B221- Aluminum-Alloy Extruded Bars, Rods, Wires, Shapes and Tubes
5. B308- Aluminum-Alloy 6061-TS Standard Structural Shapes, Rolled or Extruded
6. E283- Test Method for Rate of Air Leakage through Exterior Windows, Curtain Walls and Doors
7. E330- Test Method for Structural Performance of Exterior Windows , Curtain Walls and Doors by Uniform Static Air Pressure Difference
8. E331- Test Method for Water Penetration of Exterior Windows , Curtain Walls and Doors by Uniform Static Air Pressure Difference.

E. Federal Specifications (FS)

1. TT-P-641G(1) Primer Coating, Zinc Dust-Zinc Oxide (for Galvanized Surfaces)
2. TT-P-645A- primer, Paint, Zinc Chromate, Alkyd Type

F. Steel Structures Painting Council (SSPC)

1. Paint 12 – Cold Applied Asphalt Mastic (Extra Thick Film)

1.4 SUBMITTALS

- A. Product Data: Submit 6 copies of manufacturer's specifications, standard details, and installation recommendations for components of aluminum storefronts required for project, including data that products have been tested and comply with performance requirements.
- B. Shop Drawings: Submit 6 copies shop drawings for fabrication and installation of aluminum entrances and storefronts, including elevations, detail sections of typical composite members, anchorages, reinforcement, expansion provisions, and glazing.
- C. Samples: Submit samples of each type and color of aluminum finish.
- D. Test and certificates 6 copies of Miami-Dade Notice of acceptance and 6 copies of Laboratory test conducted to obtain Miami-Dade acceptance or Florida Building Code Acceptance.

1.5 SYSTEM REQUIREMENTS

A. Performance Requirements:

1. Air Infiltration: Air leakage through fixed light areas of storefront shall not exceed 0.06 cfm per square foot of surface area when tested in accordance with Miami- Dade County Building Code Compliance Office (BCCO) protocol (PA-202) and ASTM E283 at differential static pressure of 6.24 psf.
2. Water Infiltration: No uncontrolled leakage when tested in accordance with Miami- Dade County Building Code Compliance Office (BCCO) protocol (PA-202) and ASTM E331 at test pressure of 13.5 psf.

B. Hurricane Resistance Requirements:

1. Large Missile Impact per Miami Dade County Building Code Compliance Office (BCCO) protocol (PA-201) Test Requirements.

2. Cyclic Load Test per Miami- Dade Building Code Compliance Office (BCCO) protocol (PA-203) Test Requirements.
3. Forced Entry Resistance per South Florida Building Code (SFBC) Section 3603.2(b) 5 test requirements.
4. Uniform Static Load Test per Dade Building Code Compliance Office (BCCO) protocol (PA 202 and ASTM –E331).

## PART 2 - PRODUCTS

2.0 MANUFACTURER: Oldcastle Building Envelope, or approved equal.

2.1 PRODUCT:

A. FG5000 Flush Glazed Aluminum Window Wall System-LMI. NOA No. 12-0109.06

2.2 MATERIALS AND ACCESSORIES

- A. Aluminum Members: 6063-TS of required finish; ASTM B-221 for extrusions. ASTM B-209.
- B. Fasteners: Aluminum, non-magnetic stainless steel, or other materials warranted by manufacturer to be non-corrosive and compatible with aluminum components per Miami-Dade approval.
- C. Do not use exposed fasteners except where unavoidable for application of hardware. Match finish of adjoining metal.
- D. Concealed Flashing: Dead-soft stainless steel, 26 gauge minimum, type selected by manufacturer for compatibility.
- E. Brackets and Reinforcements: Manufacturer's high-strength aluminum units where feasible; otherwise, non-magnetic stainless steel or hot-dip galvanized steel complying with ASTM A-386.
- F. Bituminous Coatings: Cold-applied asphalt mastic complying with SSPC-PS-12, compounded for 30 mil thickness per coat.
- G. Weatherstrip accessories:
  1. SSA tape
  2. Exterior gasket
  3. Setting blocks

4. Side blocks
  5. Sealant
  6. Structural seal
  7. Sealant tape
- H. Structural Vertical reinforcement in frames 1 ¼" x 4 9/16" x ¼" steel to meet wind load required.
1. ASTM A36 for Carbon Steel or ASTM B308 for Structural Aluminum.
  2. Steel components factory coated with alkyd type zinc chromate primer complying with FSTT-P-645.

## 2.3 FABRICATION

### A. General:

1. Sizes and Profiles: Required sizes for door and frame units, including profile requirements, are shown on drawings. Any variable dimensions are indicated, together with maximum and minimum dimensions required to achieve design requirements and coordination with other work.
  2. Details shown are based upon standard details by manufacturer indicated. Similar details by other manufacturers listed will be acceptable, provided they comply with other requirements, including profile limitations.
- B. Reinforcing: Install reinforcing as necessary for performance requirements; separate dissimilar metals with bituminous paint or other separator which will prevent corrosion.
- C. Continuity: Maintain accurate relation of planes and angles, with hairline fit of contacting members.
- D. Fasteners: Conceal fasteners wherever possible.
- E. Break-metal: Provide miscellaneous break metal in the shapes and profiles shown on drawings.

## 2.4 SILL FLASHING

- A. Clear anodized aluminum break metal fabricated in profile and bent as shown on the drawings.

## 2.5 FINISHES

### A. Clear Anodized:

1. Conforming to AA-M12C22A31 and AAMA 607.1
2. Architectural Class II, etched, medium matte, clear anodic coating, 0.4 mil minimum thickness.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Comply with manufacturer's instructions and recommendations for installation of aluminum entrances and storefronts to meet Miami-Dade acceptance requirement.
- B. Set units plumb, level, and true to line, without warp or rack of framing members, doors, or panels. Anchor securely in place, separating aluminum and other corrodible metal surfaces from sources of corrosion or electrolytic action at points of contact with other materials.
- C. Drill and tap frames and doors and apply surface-mounted hardware items, complying with hardware manufacturer's instructions and template requirements. Use concealed fasteners wherever possible.
- D. Set sill members and other members in bed of compound as shown, or with joint fillers or gaskets as shown to provide weathertight construction. Comply with requirements of Division 7 for compounds, fillers, and gaskets.
- E. Set internal drainage flashing install sealant, sealant tapes and gaskets for a watertight frame meeting Miami-Dade acceptance and requirements for water infiltration test ASTM E331 and PA202.
- F. Protection: Provide protection of aluminum frames from damage.
- G. Install frame after sill water proofing/damproofing membranes are installed.

### 3.2 ADJUST AND CLEAN

- A. Adjust operating hardware to function properly, without binding and to provide tight fit at contact points and weatherstripping.
- B. Clean completed system, inside and out, promptly after erection and installation of glass and sealants. Remove excess glazing and sealant compounds, dirt, and other substances from aluminum surfaces.

THREE POINTS MAINTENANCE FACILITY  
ORANGE COUNTY, FLORIDA

SECTION 08410  
ALUMINUM STOREFRONTS

END SECTION 08410



## **SECTION 08700 - FINISH HARDWARE**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

A. All applicable provisions of the General Conditions are a part of this Section.

#### **1.2 SCOPE**

A. Work covered by this Section of Specifications consists of furnishing and delivering to the job site for fitting and installation of all finish hardware complete, in accordance with this Section and applicable drawings and subject to terms and conditions of Contract.

B. It is intended that the following list of hardware will cover all finish hardware to complete the project. Omissions and/or discrepancies shall be brought to the Architect's attention during the bidding period.

C. No substitution for locksets will be allowed.

#### **1.3 SUPPLIER**

A. Finish hardware shall be furnished by one approved by the Architect as having appropriate technical knowledge and experience to correctly interpret drawings and specifications. Supplier shall be prepared at all times during progress on installation to promptly provide competent and efficient Architectural Hardware Consultant (AHC) to approve its complete installation in order that all items shall be installed in the best manner and function properly. This will necessitate a job visit prior to final inspection.

#### **1.4 DELIVERY**

A. All items of finish hardware shall be delivered to the project site or as otherwise specified or required, and shall be checked in for completeness and familiarization with the contractor. All items of Finish Hardware shall be packaged, numbered, labeled to identify each opening for which it is intended and to correspond with item numbers on the approved Hardware Schedule.

#### **1.5 TEMPLATES**

A. All finish Hardware to be installed on or in metal doors and/or frames shall be manufactured to template. Template machine screws shall be furnished for all such materials. The supplier and Owner shall furnish Hardware Schedules as approved by the Architect and all necessary templates to metal door and frame fabricators for their coordination's use.

## 1.6 SUBMITTALS

- A. Submit complete typewritten Hardware Schedule in triplicate to the Architect for approval. After approval, provide required number of copies of approved Hardware Schedule for Distribution. No factory Order shall be placed for materials until approval has been given by the Architect.
- B. One current copy of a catalog cut shall be submitted with the Hardware Schedule for each item of hardware listed in the schedule.
- C. Each item in the Schedule shall be identified on the first page of the Schedule by the manufacturer's name.

## 1.7 RESPONSIBILITY

- A. It shall be the supplier's responsibility to furnish hardware in accordance with the intent of this specification, the functional use of door. Where, by virtue of architectural design or by function, a change is necessary, hardware of equal design and quality shall be furnished upon written acceptance of the Architect.

## 1.8 LOCATIONS

- A. Hardware locations dimension shall be as follows: Distance from finish floor to center line of :
  - 1. Door Knob 38"
  - 2. Door Pull 42"
  - 3. Deadlock 60"
  - 4. Exit Bolt Cross Bar 38"
  - 5. Push Plate 50"
  - 6. Butt Hinges
  - 7. Bottom Hinges: Finish floor to bottom of Hinge 10".
  - 8. Top Hinge: Head rabbet to top of Hinge 5".
  - 9. Center Hinge: Equal distance between top and bottom hinges.
- B. 180 DEGREES OPENINGS: Other than those doors that are restricted to less than 180 degrees opening by building or by overhead holders or stops, all butts and/or closer arms shall be of sufficient size to allow full 180 degrees opening of doors.

## PART 2 - PRODUCTS:

### A. BUTTS:

Doors 1-3/4" thick: Minimum 4-1/2" high.  
Doors 1-3/8" thick: Minimum 3-1/2" high.

1. Each door shall not have less than three hinges. Doors 8'-0" and higher shall have four (4) hinges whether specified under items or not.
2. All butts used with door closers shall be ball bearing. All exterior doors shall have ball bearing butts except as otherwise specified.
3. Accepted manufacturers are:

Stanley  
McKinney  
Approved Equal

**B. FINISH:**

- |                              |         |
|------------------------------|---------|
| 1. Butts, Exterior           | US26D   |
| 2. Butts, Interior           | US26D   |
| 3. Locks                     | US26D   |
| 4. Push, Pull, Kick Plates   | US32D   |
| 5. Closers                   | SBL, AL |
| 6. Panic Devices             | US26D   |
| 7. Door Stops, Miscellaneous | US26D   |

**C. LOCKSETS:**

Schlage (Primus) All Doors with Locks (No substitutions accepted)

- D. CLOSERS:** Closers shall be one of the following manufacturers or approved equal and shall be furnished in the manufacturers recommended printed size for the specified conditions unless otherwise noted in the hardware sets. Closers shall be full rack and pinion complete with back check. Springs shall be motor clock type. Furnish flush mount transom brackets where no transom bar exists. Furnish parallel arm where required.

MANUFACTURER  
LCN

SERIES  
As required by function and  
mounting

Von Duprin

- E. DOOR TRIM: All push plates, pulls, pull plates, kick and/or armor plates shall be any one of the following manufacturer's products or approved equal in catalog number as set forth herein:

MANUFACTURER	PUSH PLATE	PULL PLATE	KICK PLATE
Trimco	As required	As required	
Brookline	by function.	by function.	
H. B. Ives			

- F. SILENCERS: All interior wood and metal door frames shall have door silencers type 20 or 21, three per single door, two per pair of doors.

- G. DOOR HOLDERS: Holders shall be one of the following manufacturers or approved equal and shall be furnished in the manufacturer's recommended size for the specified condition unless otherwise noted in the hardware sets. All holders shall be automatic with adjustable holding force. Furnish flush mount transom brackets where no transom bar exists.

MANUFACTURER  
Glynn-Johnson  
Russwin  
Checkmate  
B. Ives

- H. DOOR STOPS: Stops shall be one of the following manufacturers or approved equal:

MANUFACTURER  
B. Ives  
Glynn-Johnson  
Quality

- I. KEYING: All locks shall be master keyed per instructions of Orange County Locksmith.

- J. FASTENING: All screws shall be of matching finish to their product and shall be the manufacturer's standard for that item.

- K. Sex Bolts: Door closers, door holders, and exit devices installed on wood door shall be attached by means of thru-bolts and sex-nuts.

PART 3 – EXECUTION

3.1 HARDWARE SETS

Provide all locksets as manufactured by Schlage/ Primus. All doors shall have removable cores and be provided by the General Contractor.

GROUP #1

DOOR #110A, 110B, 111A, 115

Door pair to have:

- 1 Dead bolt, Schlage (Primus), B762R, cylinder and thumbturn, Plate US26D, or approved equal.
- 1 Entrance lock, Schlage (Primus) D50 PD, Rhodes Lever, US26D.
- 3 Pair butts, Stanley, FBB 179, 4.5" x 4.5": N.R.P. or approved equal.
- 2 Closers, LCN 4210, hold open, or approved equal. (Application specific-see floor plan)
- 2 Sweep, Pemko, 18125AP, or approved equal.
- 1 Set Door gasket, Pemko 359A stop applied, or approved equal.
- 1 Astragal, Pemko 357 SP, or approved equal.
- 1 Astragal gasket, Pemko 357C, or approved equal.
- 2 Floor stops, Ives 441, or approved equal.
- 1 Door coordinate, Ives 469 and 469-1/2, or approved equal.
- 2 Extension flush bolts, US26D, Ives 457 and 458 UL listed (fixed door), or approved equal.
- 4 Kick Plate, Ives 8400 Us26D, or approved equal.
- 1 Dust proof floor strike, Ives 488, 26D (for fixed door), or approved equal.
- 2 Pulls, Ives 8121-5, 26D, or approved equal.
- 2 Push plates, Ives 8200, 26D, or approved equal.
- 1 Sill, Pemko 2005 AV36, or approved equal.

GROUP #2

DOOR 109A, 106A, 107A, 108A, 110C

Each door to have:

1-1/2 pair butts, Stanley, FBB 179 4.5" x 4.5", or approved equal.

- 1 Lockset, Schlage (Primus), office D50PD, office, Lever-Rhodes, US26D, or approved equal.
- 1 Door stop, Ives 407, 26D, or approved equal.
- 1 Set silencers, or approved equal.

GROUP #3

DOOR 100A, 106B

Each door to have:

1-1/2 pair butts, Stanley, FBB 179 4.5" x 4.5" NRP, or approved equal.

- 1 Lockset, Schlage (Primus), office D50PD, office, Lever-Rhodes, US26D, or approved equal.
- 1 Deadbolt, (primus) B762R, Cylinder, turn, US26D or approved equal.
- 1 Set weatherstripping, Pemko, 281CM, or approved equal.
- 1 Sweep, Pemko, 18062CP, or approved equal.
- 1 Threshold, Pemko 2005AV36, or approved equal.
- 1 Closer, LCN 4210, or approved equal.
- 2 Kick plates, Ives, 8400, 26D, Plate, or approved equal.

GROUP #4

DOOR M102A

Each door to have:

1-1/2 pair of butts, Stanley, FBB 179 4.5" x 4.5", NRP, or approved equal.

- 1 Lockset, Schlage (Primus), D80PD, Storage Room, US26D, Lever-Rhodes, or approved equal.

- 1 Deadbolt, Schlage(Primus) B762R, cylinder and thumbturn, plate, US26D, or approved equal.
- 1 Closer, LCN 4210 or approved equal.
- 1 Set Door gasket, Pemko 359A, stop applied or approved equal.
- 2 Kickplates, Ives 8400, US26D, or approved equal.
- 1 Floor stop, Ives, 441, or approved equal.
- 1 Threshold, Pemko 2005 AV36, or approved equal.

GROUP #5

DOORS 105A, 103A

Each door to have:

1-1/2 pair butts, Stanley FBB 179, 4.5" x 4.5", or approved equal.

- 1 Lockset, Schlage (Primus) D105, Passage Latch, Lever- Rhodes, US26D or approved equal.
- 2 Kickplates, Ives, 8400, US26D, or approved equal.
- 1 Closer, LCN 4210, US26, or approved equal.
- 1 Floor stop, Ives 436, or approved equal.

GROUP #6

DOOR 101A, 104A

Each door to have:

1-1/2 pair butts, Stanley FBB 179, 4.5" x 4.5" N.R.P., or approved equal.

- 1 Lockset, Schlage (Primus), D80PD, storage room, Lever-Rhodes, US26D, or approved equal.
- 1 Closer, LCN4210, US26D, or approved equal.
- 1 Door stop, Ives 407, Us26D, or approved equal.
- 1 Set silencers, or approved equal.

- 2 Kickplates, Ives, 8400, Us26D, or approved equal.

GROUP #7

Not used

GROUP #8

DOOR 111B

Self-adhesive door gasket by Pemko, S88D25, or approved equal.  
Balance of hardware by door manufacturer, or equal.

3.2 INSTALLATION

- A. Mount hardware units at heights indicated in "Recommended Locations for Builders Hardware for Custom Steel Doors and Frames" by the Door and Hardware Institute, except as specifically indicated or required to comply with governing regulations and except as otherwise directed by the Architect.
- B. Install each hardware item in compliance with the manufacturer's instructions and recommendations. Wherever cutting and fitting is required to install hardware onto or into surfaces which are later to be painted or finished in another way. Coordinate removal, storage and reinstallation or application of surface protections with finishing work specified in the Division 9 sections. Do not install surface-mounted items until finishes have been completed on the substrate.
- C. Set units level, plumb and true to line and location. Adjust and reinforce the attachment substrate as necessary for proper installation and operation.
- D. Drill and countersink units that are not factory-prepared for anchorage fasteners. Space fasteners and anchors in accordance with industry standards.

3.3 ADJUST AND CLEAN

- A. Adjust and check each operating item of hardware and each door, to ensure proper operation of function of every unit. Replace units that cannot be adjusted to operate freely and smoothly as intended for the application made.

END SECTION 08700



## SECTION 08800 – GLASS AND GLAZING

### PART 1 GENERAL

#### 1.1 RELATED DOCUMENTS

- A. The general provision of the Contract, including General and Supplementary Conditions and General Requirements apply to the work specified in this section.
- B. Section 08410 – Aluminum Entrances and Store Front.

#### 1.2 DESCRIPTION OF WORK

- A. The extent of glass and glazing work is indicated on drawings, and provisions of this section.
- B. The types of work or locations requiring glass and glazing include (but are not necessarily limited to) the following:
  - 1. Store front construction.
  - 2. Exterior entrances to be glazed.
  - 3. Interior doors to be glazed.

#### 1.3 REFERENCES

- 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.

##### AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 669	1975 (R 1989) Glazing Compounds for Back Bedding and Face Glazing of Metal Sash
ASTM C 920	1987 Elastomeric Joint Sealants
ASTM C 1036	1990 Flat Glass
ASTM C 1048	1990 Heat-Treated Flat Glass - Kind HS, Kind FT Coated and Uncoated Glass
ASTM D 673	1988 Mar Resistance of Plastics
ASTM D 4802	1988 Poly(Methyl Methacrylate) Acrylic

Plastic Sheet

ASTM E 774	1988 Sealed Insulating Glass Units
ANSI Z97.1	Safety Performance Specifications and Methods of Test for Safety Glazing Used in Buildings.
ASTM C804 ASTM C864	Use of Solvent Release Type Sealants Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers.
ASTM C1172	Laminated Architectural Safety Glass.
ASTM E84	Surface Burning Characteristics of Building Materials.
ASTM E283	Test Method for Rate of Air Leakage Through Exterior Windows, Curtain Walls and Doors.
ASTM E330	Structural Performance of Exterior Windows Curtain Walls, and Doors by Uniform Static Air Pressure Difference.
ASTM E546	Test Method for Frost Point of Sealed Insulating Glass Units.
ASTM E576	Test Method for Dew/Frost Point of Sealed insulating Glass Units in Vertical Position
ASTM E773	Test Method for Seal Durability of Sealed Insulating Glass Units.

Laminators Safety Glass Association – Standards Manual.

Sigma – Sealed Insulated Glass Manufacturers Association.

CODE OF FEDERAL REGULATIONS (CFR)

16 CFR 1201	Safety Standard for Architectural Glazing Materials
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FLAT GLASS MARKETING ASSOCIATION (FGMA)

FGMA GM	1986 Glazing Manual
FGMA SM	1983 Sealant Manual

#### FEDERAL SPECIFICATIONS (FS)

- FS L-P-391 (Rev. D) (Valid Notice 1) Plastic Sheets,  
Rods and Tubing, Rigid Cast, Methacrylate
- FS TT-P-00791 (Rev. B) (Am. 2) Putty: Linseed-Oil  
Type, (For Wood-Sash-Glazing)

#### MILITARY SPECIFICATIONS (MIL)

- MIL-R-900 (Rev. F) Rubber Gasket Material, 45  
Durometer Hardness
- MIL-P-46144 (Rev. C) (Am. 1) Plastic Sheet,  
Polycarbonate

#### NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

- NFPA 80 1990 Fire Doors and Windows

#### UNDERWRITERS LABORATORIES INC. (UL)

- UL ABPMED 1989 (Supp. 1990) Automotive, Burglary  
Protection, and Mechanical Equipment  
Directory
- UL 752 1985 (R 1990) Bullet-Resisting Equipment,  
Seventh Edition

### 1.4 PERFORMANCE REQUIREMENTS

- A. Limit glass deflection to 1/200 or flexure limit of glass with full recovery of glazing materials, whichever is less.
- B. Glass to meet wind load requirements as noted on Structural drawings for required wind load per Florida Building Code 2010. See structural drawing for load requirements.

### 1.5 SUBMITTALS

- A. Section 01300 – Shop Drawings, Samples and Product Data: Procedures for submittals.
- B. Product Data on Glass and Plastic Types: provide structural, physical and environmental characteristics, size limitations, special handling or installation requirements.

- C. Product Data on Glazing Compounds: Provide chemical, functional, and environmental characteristics, limitations, special application requirements. Identify available colors.
- D. Samples: Submit three samples 12 x 12 inch in size, examplng glass and plastic units.
- E. Submit shop drawings for fabrication including all field conditions and special adaptations to meet field conditions.
- F. Provide letters from glass manufacturer which confirm and approve installation of the glass in proposed framing systems.
- G. Submittals, Shop Drawings, and Samples.
- H. Certificates: Certify that Products meet or exceed specified requirements.

#### 1.7 QUALITY ASSURANCE

- A. Perform Work in accordance with FGMA Glazing Manual, FGMA Sealant Manual for glazing installation methods.
- B. Installer Qualifications: Company specializing in performing the work of this section with minimum five years documented experience.

#### 1.8 WARRANTY

- A. Provide a 3 year Product and installation warranty against product defect or improper installation.

#### 1.9 JOB CONDITIONS

- A. Comply with manufacturer's instructions for shipping, handling, storing and protecting glass and glazing materials. Exercise exceptional care to prevent edge damage to glass, and damage/deterioration to coatings (if any) on glass.

#### 1.10 PRODUCT HANDLING

- A. Pre-Installation Meeting: Comply with General Requirements for pre-installation meeting of Glazier and other trades affected by glass installation.
- B. Inspection: Glazier must examine framing and substrate work to receive glass and glazing materials, and conditions under which glass is to be installed, and notify Contractor in writing of conditions detrimental to proper completion of the work. Do not proceed with glazing until unsatisfactory conditions have been corrected in a manner acceptable to Glazier.

- C. Weather: Do not proceed with glazing under adverse weather conditions. Install liquid sealants when temperatures are within lower or middle third of temperature range recommended by manufacturer.

## PART 2 - PRODUCTS

### 2.1 FABRICATED GLASS UNITS

#### A. Hurricane Impact Laminated Glass

1. Manufacturer: Oldcastle Building Envelope or approved substitution  
(561) 844-3100 Fax: (561) 848-9271
2. Glass Requirements
  - a. 9/16" thick Laminate glass
  - b. Consisting of 2 plies of (1/4") PPG Solarbronze glass separated by 1 ply of (.060") clear PVB
  - c. Interior Ply tempered clear glass (1/4") thick.
    1. ASTM C1036 Type 1 Class 1 Quality q3
    2. ASTM C 1048 Condition A
3. Minimum Unit Requirements
  - a. Visible light transmission of 51%
  - b. Shading Coefficient of .65

### 2.3 SETTING AND SEALING MATERIALS

- A. Provide as specified in the FGMA GM SIGMA A3000, SIGMA A2801, and manufacturer's recommendations, unless specified otherwise herein. Do not use metal sash putty, non-skinning compounds, non-resilient preformed sealers, or impregnated pre-formed gaskets. Materials exposed to view and unpainted shall be gray or neutral color.
- B. Glazing Compound
1. ASTM C 669. Use for face glazing metal sash. Do not use with insulating glass units or laminated glass.
- C. Elastomeric Sealant
1. ASTM C 920, Type S or M, Grade NS, Class 12.5, Use G. Use for channel or stop glazing metal sash.
  2. Sealant shall be chemically compatible with setting blocks, edge blocks, and sealing tapes.
  3. Color of sealant shall be as selected by Architect.

D. Preformed Channels

1. Neoprene, vinyl, or rubber, as recommended by the glass manufacturer for the particular condition.

E. Sealing Tapes

1. Preformed, semisolid, polymeric-based material of proper size and compressibility
2. Use only where glazing rabbet is designed for tape and tape is recommended by the glass or sealant manufacturer.
3. Provide spacer shims for use with compressible tapes. Tapes shall be chemically compatible with the product being set.

F. Setting Blocks and Edge Blocks

1. Lead or neoprene of 70 to 90 Shore "A" durometer hardness, chemically compatible with sealants used, and of sizes recommended by the glass manufacturer

G. Accessories

1. provide as required for a complete installation, including glazing points, clips, shims, angles, beads, and spacer strips. Provide non-corroding metal accessories. Provide primer-sealers and cleaners as recommended by the glass and sealant manufacturers.

H. Hurricane Impact Laminated Glass Structural Silicone Glazing

1. Dow 995
2. Dow 795
3. Dow 983
4. GE Ultraglaze 4000
5. Sikaflex-295 UV
6. No substitution will be allowed.

PART 3 EXECUTION

3.1 PREPARATION

- A. Preparation, unless otherwise specified or approved, shall conform to applicable recommendations in the FGMA GM, FGMA SM, SIGMA A2801, SIGMA A3000, and manufacturer's recommendations. Determine the sizes to provide the required edge clearances by measuring the actual opening to receive the glass. Grind smooth in the shop glass edges that will be exposed in finish work. Leave labels in place until the installation is approved, except remove applied labels on heat-absorbing glass and on insulating glass units as soon as glass is installed. Securely fix movable items or keep in a closed and locked position until glazing compound has thoroughly set.

### 3.2 GLASS SETTING

- A. Shop glaze or field glaze items to be glazed using glass of the quality and thickness specified or indicated. Glazing, unless otherwise specified or approved, shall conform to applicable recommendations in the FGMA GM, FGMA SM, SIGMA A2801, SIGMA A3000, and manufacturer's recommendations. Aluminum windows, wood doors, and wood windows may be glazed in conformance with one of the glazing methods described in the standards under which they are produced, except that face puttying with no bedding will not be permitted. Handle and install glazing materials in accordance with manufacturer's instructions. Use beads or stops which are furnished with items to be glazed to secure the glass in place.

- 3.3 Watertight and airtight installation of each piece of glass is required, except as otherwise shown. Each installation must withstand normal temperature changes. Wind loading, impact loading, without failure including loss or breakage of glass, failure of sealants or gaskets to remain watertight and air-tight, deterioration of glazing materials and other defects in the work.
- 3.4 Protect glass from edge damage during handling and installation, and subsequent operation of glazed components of the work.
- 3.5 Glazing channel dimensions as shown are intended to provide for necessary bite on glass, minimum edge clearance and adequate sealant thicknesses, with reasonable tolerances. The Glazier is responsible for correct glass size for each opening, within tolerances and necessary dimensions.
- 3.6 Comply with combined recommendations of glass manufacturer and manufacturer of sealants and other materials used in glazing, except where more stringent requirements are shown or specified.
- 3.7 Voids and Filler Rods: Prevent exudation of sealant or compound by forming voids or installing filler rods in channel at heel of jambs and head (do not leave voids in the sill channels), except as otherwise indicated and depending on light size, thicknesses and type of glass, and complying with manufacturer's recommendations.
- 3.8 Do not attempt to cut, seam, nip or abrade glass which is tempered or heat strengthened, including glass which is heat-treated as a result of a coating process.
- 3.9 Force Sealants into channel to eliminate voids and to ensure complete "wetting" or bond of sealant to glass and channel surfaces.
- 3.10 Tool exposed surfaces of glazing liquids and compounds to provide a substantial

“wash” away from glass. Install pressurized tapes and gaskets to protrude slightly out of channel, so as to eliminate dirt and moisture pockets.

- 3.11 Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage to ensure that gasket will not “walk” out when installation is subjected to movement. Anchor gasket to stop with matching ribs, or by proven adhesives, including embedment of gasket tail in cured heel bead.
- 3.12 Gasket Glazing: Miter cut and bond ends together at corners where gaskets are used for channel glazing, so that gaskets will not pull away from corners and result in voids or leaks in glazing system.
- 3.13 Structural Gasket Glazing: Cut zipper strips slightly long, to ensure tight closure. Lubricate zipper strip and use special tool to install zipper. Do not lubricate glazing channel or manufacturer’s instructions, including the possible use of liquid sealants and weep holes.
- 3.14 Cure glazing sealants and compounds in compliance with manufacturer’s instructions and recommendations, to obtain high early bond strength, internal cohesive strength and surface durability.
- 3.15 Protect exterior glass from breakage immediately upon installation, by use of crossed streamers attached to framing and held away from glass. Do not apply markers to surfaces of glass.
- 3.16 Remove and replace glass which is broken, chipped, cracked, abraded or damaged in other ways during construction period, including natural causes, accidents and vandalism.
- 3.17 Maintain glass in a reasonably clean condition during construction, so that it will not be damaged by corrosive action and will not contribute (by wash-off) to deterioration of glazing materials and other work. Comply with manufacturer’s instructions.
- 3.18 Wash and polish glass on both faces not more than 4 days prior to date scheduled for inspections intended to establish date of substantial completion in each area of project. Comply with glass manufacturer’s recommendations for final cleaning.
- 3.19 Hurricane Impact Laminated Glass
  - A. Care shall be taken during handling and storage of laminated glass to ensure that glass damage will not occur. All laminated glass must be stored in a covered, cool dry and vented area. In addition all impact glass delivered shall be installed within a 30 day period to protect from damage to said units.



- B. Improper storage of laminated glass may result in damage to glass. Glass crates shall be blocked properly to prevent ripping. Consult manufacturer recommendations.
- C. Do not allow exposed edges of laminated glass to come in contact with standing water. This may cause fissures to occur within the Polycarbonate interlayer as well as delamination of the unit. Do not allow edges of the laminated glass unit to contact hard surfaces during installation. Rolling blocks shall be utilized if units need to be cartwheeled on their corners. Please refer to the Flat Glass Marketing Association glazing manual to see an example of a rolling block.
- D. Glazing Guidelines
  - 1. Care shall be taken during installation of laminated glass to ensure unit does not come in contact with frame. Improper handling may result in glass breakage. Laminated glass unit must be supported by a minimum of two silicone setting blocks or acceptable equal. It is recommended that setting blocks be installed at quarter points. Setting blocks shall 1.6 mm (1/16" less than the channel width to allow for adjustments. All setting blocks should have a hardness of 85+5 as registered on a durometer. Length of setting blocks shall be dependent upon glass area. Consult glass manufacturer for recommendations.
  - 2. Adequate edge clearance should be maintained between glass and frame. Manufacturer recommends a minimum of 6mm (1/4" edge clearance and 5mm (3/16") face clearance. Failure to maintain clearance may cause glass breakage due to glass to frame contact. If other manufacturer recommendations apply submit written information for review and acceptance.
  - 3. Laminated glass requires that all impact glass be sealed in glazing pocket and free from water intrusion. This can be achieved by use of a lock strip gasket or an approved silicone cap bead. If a weep system is used it shall be the manufacturer's responsibility to ensure a weather tight system to ensure no water comes in contact with the edge surface of the glass.
- E. Protection and Cleaning
  - 1. Glazing contractor shall protect product from damage during construction. Glazing contractor shall protect product from harmful contaminants including but not limited to acid, cement, lime, plaster, xylene and other harmful petroleum distillates. Failure to do so may void warranty.

THREE POINTS MAINTENANCE FACILITY  
ORANGE COUNTY, FLORIDA

SECTION 08800  
GLASS AND GLAZING

END SECTION 08800

## **SECTION 09220 - PORTLAND CEMENT PLASTER**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

- A. Drawings and General Provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.
- B. Section 04220 – Unit Masonry
- C. Section 07900 – Sealants

#### **1.2 DESCRIPTION OF WORK**

- A. Types of work include:
  - 1. Metal furring and lathing.
  - 2. Portland Cement plastering.
  - 3. Expansion Joints.
  - 4. Accent Joints.
  - 5. 30 lbs. Asphalt paper wrap non perforated..
- B. Locations include: Buildings exterior.
- C. Types
  - 1. Sand float finish.

#### **1.3 QUALITY ASSURANCE**

- A. Portland Cement plastering standards, A.S.T.M. C-926-81, and Portland Cement plaster manual.
- B. Allowable Tolerances for flat surfaces, do not exceed 1/4" in 8'-0" for bow or warp of surface, and for plumb or level.
  - ASTM D374 Standard Test Method for Thickness of Solid Electrical Insulation
  - ASTM D882 Standard Test Method for Tensile Properties of Thin Plastic Sheeting

- ASTM E84a Standard Test Method for Surface Burning Characteristics of Building materials
- ASTM E96 Standard Test Methods for Water Vapor Transmission of Materials.

#### 1.4 SUBMITTALS

- A. See Section 01300 "Submittals".
- B. Submit 6 copies manufacturer's product specifications and installation instructions for each material, including other data as may be required to show compliance with these specifications.

#### 1.5 PRODUCT HANDLING

- A. Deliver, store and protect manufactured materials to comply with referenced standards.

#### 1.6 JOB CONDITIONS

- A. Comply with referenced standards for environmental conditions. Protect contiguous work from soiling, spattering, moisture deterioration and other harmful effects, which might result from plastering.

#### 1.7 PRE-INSTALLATION MEETING.

- A. Conduct a pre-installation meeting with manufacturer representative prior to the start of work.

### PART 2 - PRODUCTS

#### 2.1 METAL SUPPORT, FURRING, LATHING AND ACCESSORY MATERIALS

- A. Metals and Finishes: Manufacturer's standard steel products, unless indicated as zinc alloy or other metal; where not otherwise indicated, provide manufacturer's standard galvanized finish on steel products except as follows:
  1. Exterior/Interior Components: Hot-dip galvanized finish, A.S.T.M. A-525-G-90 for 18 gage and lighter formed metal products, A.S.T.M. A-123 galvanized after fabrication for 16 gage and heavier products.
  2. Exterior/Interior Exposed Plastering Accessories: Provide zinc alloy accessories for exterior work and work in "high humidity" area.
  3. Wire Ties: Galvanized soft steel wire, 8 gauge.

2.2 METAL LATHING MATERIALS

A. Coordinate depth of accessory with thickness of number of coats of plaster to be applied.

1. 7/8" thick, three-coat system on metal lath.

2.3 SMALL NOSE CORNER BEADS

A. General-purpose type with expanded or perforated flanges.

2.4 CORNER TIE

A. Manufacturer's standard pre-formed interior corner reinforcement made from 2.5lbs. per sq. yd. galv. diamond mesh lath.

2.5 SQUARE EDGE CASING BEADS

A. Manufacturer's standard with expanded or short flange to suit application.

2.6 TWO-PIECE EXPANSION JOINTS

A. Manufacturer's standard galv. roll-formed pair of casing beads with modified back flanges providing positive slip joint action and dust barrier, adjustable for joint width variation of 1/8" to 5/8".

2.7 ONE-PIECE CONTROL JOINTS

A. Manufacturer's standard galv. roll-formed control joint with back flanges.

2.8 CORNER REINFORCEMENT

A. Special stucco-type woven galvanized wire corner reinforcing strips.

2.9 FASTENERS

A. Galvanized steel of type and length suitable for adequate penetration of the substrate.

2.10 PORTLAND CEMENT PLASTER MATERIALS

A. Provide either neat or ready-mixed (where applicable) materials, at installer's option, complying with A.N.S.I. A-42.2.

B. Base Coat Cement: Portland Cement, A.S.T.M. C-150, Type I or IA.

- C. Base Coat Lime: Special finishing hydrated lime, Type S.
- D. Base Coat Aggregate: Sand.
- E. Finish Coat: Site prepare finish coat of texture indicated.
- F. Texture: Sand float finish on exterior finishes & smooth finishes in interior surfaces.

#### 2.11 BONDING MATERIALS

- A. Bonding Additive: Acrylic-based emulsion for bonding exterior and interior Portland Cement plaster base-coat to solid substrates.
- B. Products: Quick-Cure, Ad-Liquid (FINESTONE CORP.); Acrylic Admix-101 (LARSEN PRODUCTS CORP.); or Acryl-60 (STANDARD DRYWALL PRODUCTS).

#### 2.12 PLASTER MIXES

- A. Mix for Exterior Portland Cement Plaster. Include bonding additive in accordance with manufacturer's instructions.

#### 2.13 SEALANT

- A. Install elastomeric sealants in two piece expansion joints.
- B. At butt joints of all control and expansion joint edges.

#### 2.14 LATH AND FRAMING

- A. 3.4 lbs./sq. yard sqf. furring, diamond mesh galvanized metal.
- B. Lath supported at 16" o.c. from  $\frac{3}{4}$ " furring channels 16GA and 2" channels at 48" 16 GA.

#### 1.15 THE WIRE

- A. 8 gauge galvanized wire.

#### 1.16 WEATHERIZATION MEMBRANE

- A. Asphalt saturated felt: ASTM D-226, 30 lbs, type non-perforated.
- B. Miscellaneous accessories, tape, sealants and adhesives.

#### 1.17 STUCCO HORIZONTAL ACCENT REVEALS

- A. 1 ½" wide, PVC plastic components 710-75, plastic components PRC-15-75
  - B. 1 ½" wide Joint intersections
  - C. 1 ½" wide 90 corner PRA-15-75
  - D. 1 ½" wide end stops PRES-15-75
  - E. 1 ½" wide plaster reveal inside corner PRIC-15-75
  - F. 1 ½" wide plaster reveal outside corner PROC-15-75
  - G. 1 ½" wide plaster T intersection PRT-15-75
- 1.18 FOUNDATION SCREED 631-78
- 1.19 OTHER MISCELLANEOUS ACCESSORIES
- A. Other miscellaneous accessories as required by field conditions shown or not shown on drawings.

### PART 3 - EXECUTION

#### 3.1 PREPARATION

- A. Plastering: Clean plaster bases and substrates to be plastered, removing loose materials, coatings and other substances, which might impair the work.

#### 3.2 COORDINATION

- A. Coordinate installation of plaster work with work performed under damproofing and water proofing sections.

#### 3.3 INSTALLATION OF WEATHERIZATION MEMBRANE (30 lbs asphalt paper)

- A. Conduct pre-installation conference with manufacturer
- B. Install per manufacturers written instructions and pre-installation conference instructions.

#### 3.3 INSTALLATION OF METAL SUPPORT SYSTEMS

- A. Isolation: Where lathing and metal support system abuts building structure horizontally, and where partition wall work abuts overhead structure, isolate the work from structural movement sufficiently to prevent transfer of loading into the work from the building structure. Install slip or cushion type joints to absorb deflections but maintain lateral support.

- B. Frame both sides of control and expansion joints independently, and do not bridge joints with furring and lathing or accessories.
- C. Fixture Support Framing: Install supplementary framing, blocking and bracing where work is indicated to support fixtures, equipment, services, casework, heavy trim and furnishings and similar work requiring attachment and support.

### 3.4 METAL LATHING

- A. Install metal lath to comply with referred standards unless otherwise indicated over damproofing membrane.

### 3.5 PLASTER ACCESSORIES

- A. Anchor each flange of accessories 8" o.c. to plaster base. Miter cope accessory corners and install with tight joints accurately aligned. Set accessories plumb, level and true to line with a tolerance of 1/8" in 10'-0". Install metal corner beads at external corners.
- B. Install casing beads at terminations of plaster work, except where plaster is indicated to pass through other work and be concealed by lapping work, and except where special screens, bases or frames act as casing beads including interior metal door frames.
- C. For exterior work, set casing beads 1/4" from abutting frames and other work (for application of sealant).
- D. Install prefabricated expansion joints of 2-piece design where shown as "expansion joint".

### 3.6 INSTALLATION OF PLASTER

- A. Mechanically mix plaster materials at the project site. Do not hand mix except where small amounts are needed, using less than one bag of plaster. Sequence plaster installation properly with the installation and protection of other work so that neither will be damaged by the installation of the other.
- B. Plaster flush with metal frames and other built-in metal items or accessories, which act as a plaster ground, unless otherwise shown. Where plaster is not terminated at metal by casing beads, cut base coat free from metal before plaster sets and groove finish coat at the junctures with metal.
- C. Apply thicknesses and number of coats of plaster as indicated, or as required by referenced standards. Provide 3-coats 7/8" total thickness plaster at metal lath installation.



### 3.7 TEXTURE OF PLASTER FINISHES

A. Except as otherwise indicated, apply finish coat as follows:

1. Exterior Portland Cement Plaster: Sand Float finish.

### 3.8 CUTTING AND PATCHING

A. Cut, patch, point-up and repair plaster as necessary to accommodate other work and to restore cracks, dents and imperfections. Repair or replace work to eliminate blisters, buckles, excessive crazing and check cracking, dry-outs, efflorescence, sweat-outs and similar defects, including areas of the work which do not comply with specified tolerances and where bond to the substrate has failed. Sand smooth troweled finishes lightly to remove trowel marks and arises.

### 3.9 CLEANING AND PROTECTION

- A. Remove temporary protection and enclosure of other work. Promptly remove plaster from doorframes, windows, and other surfaces that are not to be plastered. Repair floors, walls, and other surfaces that have been stained, marred or otherwise damaged during the plastering work. When plastering work is completed, remove unused materials, containers and equipment and clean floors of plaster debris.
- B. Installer shall advise the Contractor of requirements for the protection of plaster from deterioration and damage during the remainder of the construction period.

END SECTION 09220

## **SECTION 09250 - GYPSUM DRYWALL**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

- A. The General Provisions of the Contract, including General and Supplementary Conditions and General Requirements (if any) apply to the work specified in this section.

#### **1.2 DESCRIPTION OF WORK**

- A. The extent of the gypsum drywall and support framing work specified here in and shown on the drawings and in schedules, and is hereby defined to include gypsum board work with a tape and compound joint treatment system and other applied finishes know as "drywall finishing" work.

#### **1.3 QUALITY ASSURANCE**

- A. Fire-Resistant Rating: Where work is indicated for fire-resistant ratings, including those required to comply with governing regulations provide materials and installations identical with applicable assemblies which have been tested and listed by recognized authorities, including U.L. and F.M. Comply with F.M. "Approval Guide" where applicable.
- B. Installer: Use a manufacturer accepted installer with experience in this trade.
- C. Industry Standard: Comply with applicable requirements of GA-216-00 "Application and Finishing of Gypsum Board" by the Gypsum Association, except where more detailed or more stringent requirements are indicated including the recommendations of the manufacturer.
- D. Allowable Tolerances: With 1/8" offsets between planes of board faces and 1/4" in 8' -0" for plumb, level, warp and bow.
- E. Manufacturer: Obtain gypsum boards, trim accessories, adhesives and joint treatment products from a single manufacturer, or from manufacturer's of gypsum boards.
- F. Obtain metal support materials and fastener from a single manufacturer.
- G. Florida Building Code requirements for firestop/draftstopping of walls.

#### **1.4 SUBMITTALS**

- A. Manufacturer's Data: Submit (6) copies of manufacturer's product

specifications and installation instructions for each gypsum drywall, metal support component, and DUROCK board, or accepted equal, including other data as may be required to show compliance with these specifications.

#### 1.5 PRODUCT HANDLING

- A. Deliver materials in sealed containers and bundles, fully identified with manufacturer's name, brand, type and grade; store in a dry, well ventilated space, protected from the weather, under cover and off the ground.

#### 1.6 JOB CONDITIONS

- A. Installer must examine the substrates and the spaces to receive gypsum drywall, and the conditions under which gypsum drywall is to be installed; and shall notify the Contractor, in writing, of conditions detrimental to the proper and timely completion of the work. Do not proceed with the installation until unsatisfactory conditions have been corrected in a manner acceptable to the Installer.
- B. Maintain ambient temperatures at not less than 55 degrees F. for the period of 24-hours before drywall finishing, during installation and until compounds are dry.

#### 1.7 HAZARDOUS MATERIAL:

- A. **Do not** use asbestos materials, additives and reinforcement in any products, materials, or accessories required for the project.

### PART 2 - PRODUCTS

#### 2.1 METAL SUPPORT MATERIALS

- A. General: To the extent not otherwise indicated, comply with Gypsum Association Specification GA-203 "Installation of Screw-Type Steel Framing Members to Receive Gypsum board" (as specified and recommended) for metal system supporting gypsum drywall work.
- B. Studs: ASTM C 645; 25 gauge x 3-5/8" deep, except as otherwise indicated.
- C. Studs for Durock Walls: 20 gauge x 3-5/8" deep, G60 hot-dipped galvanized.
- D. Runners: Match studs; type recommended by stud manufacturer for floor and ceiling support of studs, and for vertical abutment of drywall work at other work.
- E. Stud System Accessories: Provide stud manufacturer's standard clips, shoes, ties, reinforcements, fasteners and other accessories as needed for a

complete stud system.

- F. Suspended Members: ASTM C-645; 20- gauge, hat-shaped and 18 gauge 2 1/2" Channels.
- G. Furring: ASTM C-645; 20 gauge, 1" 'Z' frame.
- H. Fasteners: Type and size recommended by furring manufacturer for the substrate and application indicated.
- I. One Hour Ceiling Assembly: As noted on drawings.

## 2.2 GYPSUM BOARD PRODUCTS

- A. GENERAL: To the extent not otherwise indicated, comply with GA-216, as specified and recommended.
  - 1. Exposed Gypsum Board: Also know as gypsum wallboard. Regular type with tapered long edges.
    - a) Sheet Size: 4' x8'.
    - b) Thickness: 5/8" except where otherwise indicated.
    - c) Type "X": Provide where indicated (fire resistant).
  - 2. Gypsum Backing Board: Regular type, with V-groove or square edges, except provide exposed gypsum boards with tapered edges where joint treatment is required.
    - a) Thickness: 5/8" except where otherwise indicated.
    - b) Thickness: 1/2" except where otherwise indicated.
    - c) Type "X": Provide where indicated (fire resistant).

## 2.3 TRIM ACCESSORIES

### A. GENERAL:

- 1. Manufacturer's standard galvanized steel beaded units with flanges for concealment in joint compound, including corner beads, edge trim and control joints; except provide semi-finishing type (flange not concealed) where indicated.

## 2.4 JOINT TREATMENT MATERIALS

A. GENERAL:

1. C-475; type recommended by the manufacturer for the application indicated, except as otherwise indicated.
  - a) Joint Tape: Perforated type.
  - b) Joint Compound: Ready-mixed vinyl-type for interior use.
  - c) Grade: Two separate grades, one specifically for bedding tapes and filling depressions, and one for topping and sanding.

2.5 MISCELLANEOUS MATERIALS

A. GENERAL:

1. Provide auxiliary materials for gypsum drywall work of the type and grade recommended by the manufacturer of the gypsum board.
2. Lamination Adhesives: Special adhesive for joint compound specifically recommended for laminating gypsum boards.
3. Gypsum Board Fasteners: Comply with GA-216-00.
4. Concealed Acoustical Sealant: Latex, acrylic, or acrylic-latex type; permanently elastic and paintable.

B. Tile Backer Board Materials:

1. Board: "DUROCK Interior Cement Board", 5/8" thick, 48" x 96", or accepted equal.
2. Joint: "DUROCK Interior Tape", or accepted equal.
3. Fasteners: DUROCK Steel Screws lengths as recommended for installation by manufacturer, or accepted equal.
4. Miscellaneous Materials: Provide auxiliary materials complete for "DUROCK" Board work of the type and grade recommended by the manufacturer of the "DUROCK" Board, or accepted equal.

PART 3 - EXECUTION

3.1 INSTALLATION OF METAL SUPPORT SYSTEMS

A. General:

1. To the extent not otherwise indicated, comply with GA-203, and manufacturer's instructions.
2. Do not bridge building expansion joints with support system, frame both sides of joints with furring and other support as indicated.
3. Isolate stud system from transfer to structural loading to system, both horizontally and vertically. Provide slip or cushioned type joints to attain lateral support and avoid axial loading.
4. Install runner tracks at floors, ceiling and structural walls and columns where gypsum drywall stud system abuts other work.
5. Space studs 16" O.C., except as otherwise indicated.
6. At all intersections use solid plate and sill members to provide firestop and draftstop as required by the building code.

B. Door Frames:

1. Install additional Jamb studs at door frames as indicated, but not less than 2 studs at each jamb. Space jack studs over door frames at same spacing as partition studs.
2. Wire -tie or clip furring members to main ceiling runners and to other structural supports as indicated.
3. Space wall furring members 16" o.c., except as otherwise indicated.
4. Nail or screw furring members to structural support where possible; otherwise wire-tie to clip as recommended by manufacturer.
5. Install supplementary framing, runners, furring, blocking and bracing at opening and terminations in the work, and at locations required to support fixtures, equipment, handicap accessories, toilet accessories, heavy trim, furnishing and similar work which cannot be adequately supported directly on gypsum board alone.

3.2 GENERAL GYPSUM BOARD INSTALLATION REQUIREMENTS

A. Pre-Installation Conference: Meet at the project site with the installers of related work and review the coordination and sequencing of work to ensure that everything to be concealed by gypsum drywall has been accomplished, and that chases, access panels, openings, supplementary framing and blocking and similar provisions have been completed.

B. General Standards: In addition to compliance with GA-216, comply with

- manufacturer's instructions and requirements for fire-resistance UL rating.
- C. Install wall/partition boards vertically to avoid end-butt joints wherever possible. At stairwells and similar high walls, install boards horizontally with end joints staggered over studs.
  - D. Form control joints and expansion joints with space between edges of boards, prepared to receive trim accessories.
  - E. Cover both faces of steel studs with gypsum board in concealed spaces (above ceilings, etc.), except in chase walls, which are properly braced internally.
  - F. Except where concealed application is required for sound, fire, air or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq.ft. and limited not less than 75% of full coverage.
  - G. Isolate perimeter of non-load-bearing drywall partitions at structural abutments. Provide 1/4" to 1/2" space and trim edge with J-type semi-finishing edge trim. Seal joints with acoustical sealant. Do not fasten drywall directly to stud system runner tracks.

### 3.3 FLOATING CONSTRUCTION

- A. Where feasible, including where recommended by manufacturer, install gypsum board with "floating" internal corner construction, unless isolation of the intersecting boards is indicated or unless control or expansion joints are indicated.
- B. Where sound-rated drywall work is indicated (STC rating), including double-layer work and work on resilient furring, seal the work at perimeters, control and expansion joints, openings and penetrations with a continuous bead of acoustical sealant including a bead at both faces of partitions. Comply with manufacturer's recommendations for location of beads, and close off sound-flanking paths around or through the work, including sealing of partitions above acoustical ceilings.
- C. Space fasteners in gypsum boards in accordance with GA-216 and manufacturer's recommendations, except as otherwise indicated.

### 3.4 INSTALLATION OF DRYWALL TRIM ACCESSORIES

- A. GENERAL: Where feasible, use the same fasteners to anchor trim accessory flanges as required to fasten gypsum board to the supports. Otherwise, fasten flanges by nailing or stapling in accordance with manufacturer's instructions and recommendations.

1. Install metal corner beads at external corners of drywall work. Install metal edge trim whenever edge of gypsum board would otherwise be exposed or semi-exposed, and except where plastic trim is indicated. Provide type with face flange to receive joint compound except where semi-finishing type is indicated. Install "L" type trim where work is tightly abutted to other work, and install special kerf-type where other work is kerfed to receive long leg of "L" type trim. Install "U" type trim where edge is exposed, revealed, gasketed, or sealant filled (including expansion joints).
2. Install "J" type semi-finishing trim where indicated, and where exterior gypsum board edges are not covered by applied moldings. Install plastic edge trim where indicated on wall panels at juncture with ceilings. Install metal control joint (beaded-type) where indicated. Install "H" molding in exterior gypsum drywall work where control joints are indicated.

### 3.5 INSTALLATION OF DRYWALL FINISHING

- A. GENERAL: Apply treatment at gypsum board joints (both directions), flanges of trim accessories, penetrations, fasteners, heads, surface defects and elsewhere as required to prepare work for decoration. Prefill open joints and rounded or beveled edges, using type of compound recommended by manufacturer. Apply joint compound in two coats (not including prefill of openings in base), and sand after last coat.
1. Surface Wall Texture: Texture shall be in accordance with design specifications (e.g., Level 5), and shall be such that all irregularities in the drywall surface are imperceptible.
  2. Partial Finishing: Omit third coat (if specified) and sanding on concealed drywall work which is indicated for drywall finishing, including sound, fire, air and smoke-rated work.
  3. Installer shall advise Contractor of required procedures for protection of the gypsum drywall work from damage and deterioration during the remainder of the construction period.

### 3.6 INSTALLATION OF DUROCK BOARD

- A. Follow manufacturer instructions for installation and finishing. Use only manufacturer authorized materials and installation methods.

END SECTION 09250



## **SECTION 09320 - TILE WORK**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

- A. The General Provisions of the Contract, including General and Supplementary Conditions and General Requirements apply to the work specified in this Section.

#### **1.2 DESCRIPTION OF WORK**

- A. The extent of tile work specified here in and as shown on drawings and in schedules.

#### **1.3 QUALITY ASSURANCE**

- A. Manufacturer's Standards: Furnish tile conforming with Standard Grade requirements of T.C.A. 137.1, latest edition.
- B. When using setting and grouting materials manufactured under T.C.A. License, include identification together with formula on each container. Provide materials obtained from only one source for each type and color of tile.
- C. Proprietary Materials: Handle, store, mix and apply proprietary setting and grouting materials in compliance with manufacturer's instructions.

#### **1.4 SUBMITTALS**

- A. See Section 01300 "Submittals"
- B. Manufacturer's Data: Tile Work: Submit 6 copies of manufacturer's technical information and installation instructions for all materials required, except bulk materials. Include certifications and other data as may be required to show compliance with these specifications.
- C. Provide sample color specified for final owner user approval.
- D. Samples; Tile Work: Submit 3 samples of each type and color of tile required, not less than 12" square on plywood or hardboard backing, and grouted. Also, submit one full-size sample of each tile accessory and two 6" long samples of marble threshold. Submit samples of trim and other units if requested by Architect. Review will be for color, pattern and texture only. Compliance with all other requirements is the exclusive responsibility of the

Contractor.

- E. Extra Stock: Supply extra 25% of each tile used in clean marked cartons for Owner's emergency use.

## 1.5 DELIVERY AND STORAGE

- A. Deliver packaged materials and store in original containers with seals unbroken and labels intact until time of use in accordance with manufacturer's instructions.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. American Olean, or accepted equal.
- B. Daltile, or accepted equal.

### 2.2 MATERIALS

- A. Ceramic Mosaic Tile: Standard Grade ceramic mosaics conforming to ANSI A137.1 as manufactured by Daltile or accepted equal. 2"x2", color: "Mottled Medium Brown" or as indicated on the drawings.
- B. Abrasive Tile: Provide abrasive finished tile at all shower floors.
- C. Temporary Coating: Furnish tile, which is to be grouted with furan or non-water-cleanable epoxy with manufacturer's standard wax coating to prevent damage to exposed tile surfaces by grouting operations.
- D. Trim Shapes: As required for complete installation of same material, size, color and finish of field tile.
- E. Observe following requirements:
  - 1. Walls: In-Corners square
  - 2. Walls: Bullnose cap on wainscot or base
  - 3. Floors: Cove base required
  - 4. Curbs: Bullnose and cove are required for smooth rounded surface.
- F. Ceramic Tile: Standard Grade ceramic tiles conforming to ANSI A137.1 as manufactured by Daltile or accepted equal. 4"x4", color "Almond 0135".
- G. Trim Shapes: As required for complete installation of same material, size, color and finish of field tile.

H. Observe following requirements:

1. Walls: In-Corners square
2. Walls: Bullnose cap on wainscot or base
3. Floors: Cove base required
4. Curbs: Bullnose and cove are required for smooth rounded surface.

I. Marble Thresholds: Provide sound Group "A" marble with an abrasive hardness of not less than 10.0 when tested in accordance with ASTM C-241. Furnish white marble for thresholds, unless otherwise indicated.

J. Epoxy Grout: For floor tile, provide a 2-component epoxy resin and hardener complying with ANSI A-118.3.

1. Manufacturer: Provide epoxy grout as manufactured by one of the following:
  - a) Syracuse Adhesive Company, or accepted equal.
  - b) Laticrete International, Inc., or accepted equal.
2. Color to be "Straw 94" or as indicated on the drawings.

K. Shower liner: AFCO shower pan, copper fabric bonded to two layers of asphalt impregnated cotton fabric. (617) 623-7700. Or approved equal.

## PART 3 - EXECUTION

### 3.1 INSPECTION

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

### 3.2 INSTALLATION

A. Standards: Use Tile Council of America Inc. 1996 Handbook for Ceramic Tile Installation.

B. General: Comply with ANSI standard installation specifications A-108.1 through A-108.7, except as otherwise indicated. Maintain minimum temperature limits and installation practices as recommended by proprietary mortar and grout materials manufacture.

- C. Extend tile work into recesses and under equipment and fixtures to form a complete covering without interruptions, except as otherwise shown. Terminate work neatly at obstructions, edges and corners without disruption of pattern or joint alignments.
- D. Comply with the manufacturer's instructions for mixing and installation of proprietary materials. Neutralize and seal substrates in accordance with mortar or adhesive manufacturer's instructions.
- E. Setting Beds: Provide setting beds as shown. If not shown, provide one of the following, subject to the specified limitations. Use Portland Cement for setting beds for walls and floors on substrates where thickness permits.
- F. Jointing Pattern: Unless otherwise shown, lay tile in grid pattern. Align joints when adjoining tile on floor, base, walls and trim are the same size. Layout tile work and center tile fields both directions in each space or on each wall area. Adjust to minimize tile cutting. Provide uniform joint widths, unless otherwise shown.
- G. Placement: Comply with applicable requirements of the specified standards for installation.
- H. Grout: Use epoxy grout where shown or scheduled. Use pre-grouted sheets where shown or scheduled. Field-grout perimeter of individual sheets with the same elastomeric material as used in the factory pre-grouted sheets.
- I. Expansion and Control Joints: Provide where shown and as detailed on drawings. Floor expansion control joint in floor slab shall align with tile expansion joints. Sealants for expansion and control joints are specified in the Sealant Sections of these specifications. Use sealant comparable with tile installation.
- J. Metal Edge Strips: Provide where shown and where exposed edge of ceramic tile flooring is to meet carpet, wood, or other resilient floor covering.
- K. Cleaning: Upon completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.
- L. Unglazed tile may be cleaned with acid solutions only when permitted by the tile and grout manufacturer's printed instructions, but not sooner than 14 days after installation. Protect metal surfaces, cast iron and vitreous plumbing fixtures from effects of acid cleaning. Flush the surface with clean water before and after cleaning.
- M. Finish Tile Work: Leave finished installation clean and free of cracked, chipped, broken, unbonded, or otherwise defective tile work.

- N. Protection: When recommended by the tile manufacturer, apply a protective coat of neutral protective cleaner to completed tile walls and floors. Protect installed tile work with Kraft paper or other heavy covering during the construction period to prevent damage and wear. Prohibit all foot and wheel traffic from using tiled floors for at least 3 days, preferably 7 days.
- O. Before final inspection, remove protective coverings and rinse neutral cleaner from all tile surfaces.

END SECTION 09320

## **SECTION 09510 - ACOUSTICAL CEILINGS**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

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

#### **1.2 SUBMITTALS**

- A. Product Data: Provide 6 copies of manufacturer's product specifications and installation instructions for each acoustical ceiling material required, and for each suspension system, including certified laboratory test reports and other data as required to show compliance with these specifications.
- B. Samples: 12" square sample for each acoustical unit required showing full range of exposed color and texture to be expected in completed work.
- C. 12" long sample of each exposed runner and molding.

#### **1.3 JOB CONDITIONS**

- A. Space Enclosure: Do not install interior acoustical ceilings until space enclosed and weatherproof, and until wet-work in space completed and nominally dry, and until work above ceilings completed, and until ambient conditions of temperature and humidity will be continuously maintained at values near those indicated for final occupancy.

### **PART 2 - PRODUCTS**

#### **2.1 CEILING UNITS**

- A. Acoustical Panels: Provide manufacturer's standard lay-in panels of type recommended by manufacturer for application indicated. Provide sizes shown by reflected ceiling plans or, if not otherwise indicated, 24" x 24" grid-size panels, with white washable finish.
- B. Material Fiber Acoustical Panels: Provide units not less than 5/8" thick and of density not less than 10 lbs. per cu. ft., medium-coarse non-directional texture, NRC 0.50 to 0.60 STC 35 to 39, light reflection over 75%.
- C. Products/Manufacturer: "Armstrong" 24" x 24", "Cortega" Class A, FS-SS-S-118B, with UL label, or accepted equal.
- D. Color: White

## 2.2 CEILING SUSPENSION MATERIALS

- A. Comply with ASTM C-635, as applicable to type of suspension system required for type of ceiling units indicated. Coordinate with other work supported by or penetrating through ceilings, including light fixtures, HVAC equipment, soffits, fans and partition system (if any).
- B. Structural Class: Intermediate-duty system.
- C. Hanger Wires: Galvanized carbon steel, ASTM A-641, soft temper, prestretched, yield-stress load of at least 3 times design load, but not less than 12-gauge (0.106").
- D. Type of System: Indirect-hung suspension system. Provide under the work of this Section, supplemental framing as required for proper spacing of hanger wires and other items suspended such as fans, and electric fixtures.
- E. System Manufacturer: One of the following:
  - 1. Chicago Metallic Corp.
  - 2. Donn Corp.
  - 3. National Rolling Mills Co.
  - 4. Roper Eastern Bldg. Systems.
- F. Edge Moldings: Manufacturer's standard channel molding for edges and penetrations of ceiling, with single flange of molding exposed, white baked enamel finish unless otherwise indicated.
- G. Exposed Suspension System: Manufacturer's standard exposed runners, cross-runners and accessories, of types and profiles indicated, with exposed cross runners coped to lay flush with main runners.
- H. Finish of Exposed Members: Provide uniform factory-applied finish on exposed surfaces of ceiling suspension system, including moldings, trim, and accessories.
- I. Finish: Manufacturer's standard baked enamel finish, white unless otherwise selected by Architect.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Measure each ceiling area and establish layout of acoustical units to balance border widths at opposite edges of each ceiling. Avoid use of less-than-half width units at borders, and comply with reflected ceiling plans wherever possible.

### 3.2 INSTALLATION

- A. General: Install materials in accordance with manufacturer's printed instructions, and comply with governing regulations, fire resistance rating requirements as indicated, and industry standards applicable to work.
- B. Arrange acoustical units and orient directionally-patterned units (if any) in manner shown by reflected ceiling plans.
- C. Install tile with pattern running in one direction.
- D. Install suspension systems to comply with ASTM C-636, with hangers supported only from building structural members or supplemental framing supported by building structural members. Locate hangers near each end and spaced 4'-0" along each carrying channel or direct-hung runner, unless otherwise indicated, leveling to tolerance of 1/8" in 12'-0".
- E. Secure wire hangers by looping and wire-tying, either directly to structures or supplemental framing.
- F. Install edge moldings to type indicated at perimeter of acoustical ceiling area and at locations where necessary to conceal edges of acoustical units.
- G. Screw-attach moldings to substrate at intervals not over 16" o.c. and not more than 3" from ends, leveling with ceiling suspension system to tolerance of 1/8" in 12'-0". Miter corners accurately and connect securely.
- H. Install acoustical panels in coordination with suspension system, with edges concealed by support of suspension members. Scribe and cut panels to fit accurately at borders and at penetrations.

### 3.3 ADJUST AND CLEAN

- A. Clean exposed surfaces of acoustical ceilings including trim, edge moldings, and suspension members; comply with manufacturer's instructions for cleaning and touch-up of minor finish damage. Remove and replace work which cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.
- B. Replace damaged tiles or suspension system.

END SECTION 09510



## **SECTION 09660 - RESILIENT FLOORING**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

- A. The General Provisions of the Contract, including General and Supplementary conditions and General Requirements (if any), apply to the work specified in this section.

#### **1.2 DESCRIPTION OF WORK**

- A. The extent of resilient flooring and accessories specified herein and also shown on the drawings and in schedules.

#### **1.3 QUALITY ASSURANCE**

- A. Wherever possible, provide resilient flooring and accessories produced by a single manufacturer.

#### **1.4 SUBMITTALS**

- A. Submit the following in accordance with Section 01300, "Submittals".
- B. Provide a letter of certification from the manufacturer that material provided do not contain asbestos.
- C. Manufacturer's Data - Resilient Flooring: For information only, submit (6), six copies of manufacturer's technical data and installation instructions for each type of resilient flooring and accessory. Transmit a copy of each installation instructions to Installer.
- D. Samples - Resilient Flooring: Submit (6) sets of samples of each type, color and finish of resilient flooring and accessory required. Provide full-size tile units and 12" square samples of sheet flooring and 6" long sample of accessory. Include full range of flooring color and pattern variation. Sample submittals will be reviewed for color texture and pattern only. compliance with all other requirements is the exclusive responsibility of the contractor.
- E. Maintenance Instructions - Resilient Flooring: Submit (2) copies of manufacturer's written instructions for recommended maintenance practices for each type of resilient flooring and accessories.
- F. Replacement Material - Resilient Floors: After completion of work, deliver replacement materials to the project site, as follows: Tile flooring, not less

than one box for each 50 boxes, or fraction thereof, for each type, size and color installed. Furnish replacement materials from the same manufactured lot as the materials installed.

## 1.5 JOB CONDITIONS

- A. Continuously heat areas to receive flooring to 70 degrees F. for at least 48 hours prior to installation, when project conditions are such that heating is required. Maintain 70 degrees F. temperature continuously during and after installation as recommended by flooring manufacturer, but for not less than 48 hours.
- B. Store tiles in space 24 hours before installation for material acclimation to environmental conditions of the space.

## PART 2 - PRODUCTS

### 2.1 COLOR AND PATTERNS

- A. Provide colors and patterns as shown or scheduled, or as selected by Architect from manufacturer's standards.

### 2.2 TILE FLOORING

- A. Vinyl Composition Tile (VCT): FS SS-T-312, Type IV, 12" x 12" x 1/8" manufacturer's standard gage for color/pattern selected.
- B. Manufacturer: Armstrong Imperial Texture or accepted equal color to be selected by the Architect or as listed on the drawings.

### 2.3 ACCESSORIES

- A. Resilient Base: (VB) Provide vinyl base complying with FS SS-W-40, Type II, with matching end stops and performed or molded corner units, as follows:
  - 1. Height: 4".
  - 2. Thickness: 0.080" gage.
  - 3. Style: Standard top-set cove, (VB-1). Standard top - straight bottom (VB-2) inside cabinet.
  - 4. Manufacturer: Johnsonite or accepted equal, submit sample for final acceptance by owner. Color- 80 Fawn
  - 5. Metal Edge Strips: Of width shown and of required thickness to protect

exposed edge of resilient flooring. Provide units of maximum available length, to minimize number of joints.

6. Material: Vinyl plastic, unless otherwise shown.
7. Adhesives/Cements: As recommended by flooring manufacturer to suit material and substrate conditions.
8. Concrete Slab Primer: Non-staining type as recommended by flooring manufacturer.
9. Crack Filler: As recommended by the floor covering manufacturer.
10. Wax: FS P-W-155
11. Polish: FS P-F-430
12. Acclimation to space of 24 hours in environment intend for installation.

### PART 3 - EXECUTION

#### 3.1 INSPECTION

- A. Installer must examine the areas and conditions under which resilient flooring and accessories are to be installed and notify the Contractor in writing of conditions detrimental to the proper and timely completion of the work.
- B. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to the Installer.

#### 3.2 PREPARATION

- A. Prior to laying of floor, broom clean or vacuum surfaces to be covered and inspect sub-floor. Start of floor installation indicates acceptance of sub-floor conditions and full responsibility for completed work.
- B. Use leveling compound as recommended by flooring manufacturer for filling small cracks and depressions in subfloors.
- C. Perform moisture tests on concrete slabs to determine that concrete surfaces are sufficiently cured and ready to receive flooring.
- D. Apply concrete slab primer, if recommended by flooring manufacturer, prior to application of adhesive. Apply in compliance with manufacturer's directions.

### 3.3 INSTALLATION

- A. General: Install flooring after finishing operations, including painting has been completed and permanent heating system is operating. Moisture content of concrete slabs, building air temperature and relative humidity must be within limits recommended by flooring manufacturer.
- B. Place flooring with adhesive cement in strict compliance with manufacturer's recommendations. Butt tightly to vertical surfaces, thresholds, nosings and edgings. Scribe around obstructions to produce neat joints, laid tight, even and straight. Extend flooring into toe spaces, door reveals and into closets and similar openings.
- C. Maintain reference markers, holes, or openings that are in place or plainly marked for future cutting by repeating on finish flooring as marked on sub-floor. Use chalk or other non-permanent marking device.
- D. Install flooring on covers for telephone and electrical ducts, and other such items as occur within finished floor areas.
- E. Maintain overall continuity of color and pattern with pieces of flooring installed in these covers. tightly cement edges to perimeter of floor around covers and to covers.
- F. Tightly cement flooring to sub-base without open cracks, voids, raising and puckering at joints, telegraphing or adhesive spreader marks or other surface imperfections.
- G. Tile Floors: Lay tile from center marks established with principal walls, discounting minor offsets, so that tile at opposite edges of the room are of equal width. Adjust as necessary to avoid use of cut widths less than 1/2 tile at room perimeters. Lay tile square to room axis, unless otherwise shown.
- H. Match tiles for color and pattern by using tile from cartons in same sequence as manufactured and packaged. Cut tile neatly to and around all fixtures. Broken, cracked, chipped or deformed tile are not acceptable.
- I. Lay tile with grain in tile running in the same direction.
- J. Accessories: Apply resilient base to walls, columns, pilasters, casework and other permanent fixtures in rooms or areas where base is required. Install base in as long lengths as practicable, with preformed corner units, or fabricated from base materials with mitered or coped inside corners. Tightly bond base to backing throughout the length of each piece, with continuous contact at horizontal and vertical surfaces.

- K. On masonry surfaces, or other similar irregular surfaces, fill voids along top edge of resilient wall base with manufacturer's recommended adhesive filler material.
- L. Apply but-type metal edge strips where shown on drawings, and prior to resilient flooring. Secure units to substrate with countersunk stainless steel anchors, complying with manufacturer's recommendations.

#### 3.4 CLEANING AND PROTECTION

- A. Remove any excess adhesive or other surface blemishes, using neutral type cleaners as recommended by floor manufacturer. Protect installed flooring from damage by covering.
- B. Finishing: After completion of project and just prior to final inspection of work, thoroughly clean floors and accessories.
- C. Apply wax and buff, with type of wax, number and coats and buffing procedures in compliance with floor manufacturer's instructions.

END SECTION 09660

## **SECTION 09900 - PAINTING**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

- A. Drawings and General Provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification sections apply to the work specified in this Section.

#### **1.2 DESCRIPTION OF WORK**

- A. Extent of painting work shown on drawings and as herein specified. The Owner requires sole source responsibility for cleaning and preparation of all surfaces prior to priming and painting.
- B. The work includes painting and finishing of interior and exterior exposed items and surfaces throughout project, except as otherwise indicated. Surface preparation and priming shall be included in the bid.
- C. The work includes field painting of exposed bare and covered pipes and ducts, exposed steel and iron work, and primed metal surfaces of equipment installed under mechanical and electrical work which are visible on the exterior of the building or are visible in occupied interior spaces.
- D. "Paint" as used herein, means all coating systems materials, including primers, emulsions, enamels, stains, sealants and fillers and other applied materials, whether used as primer, intermediate or finish coats and the preparation of the surfaces prior to the application of the coat systems.
- E. Paint exposed surfaces, whether or not colors are designated in "schedules" except where natural finish of material is specifically noted as a surface not to be painted. Where items or surfaces are not specifically mentioned, paint same as adjacent similar material or areas. If color or finish is not designated, Architect will select these standard colors on the schedule for material systems specified.
- F. The following categories of work are not included as part of field-applied finish work, or are included in other sections of these specifications:
  - 1. Shop Priming: This is only for new materials, unless otherwise specified, shop priming of ferrous metal items is included under various sections for new structural steel, new miscellaneous metal, new hollow metal work and similar items.
  - 2. Mechanical and Electrical Work: Painting of mechanical and electrical

work in unoccupied and concealed space is not required.

3. Pre-Finished Items: Unless otherwise indicated, do not include painting when factory-finishing is specified.
4. Concealed Surfaces: Unless otherwise indicated, painting is not required on surfaces such as walls or ceilings in concealed areas and generally inaccessible areas.
5. Finished Metal Surfaces: Metal surfaces of anodized aluminum and similar finished materials will not require finish painting, unless otherwise indicated.

### 1.3 SUBMITTALS

- A. Product Data: Submit manufacturer's technical information including paint label analysis and application instructions for each material proposed for use.
- B. Do not order any materials until final color selection has been accepted by the owner.

### 1.4 DELIVERY AND STORAGE

- A. Deliver materials to job site in original, new and un-opened packages and containers bearing manufacturer's name and label, and the following information:
  1. Name and title of materials.
  2. Manufacturer's name.
  3. Color name and number.

## PART 2 - PRODUCTS

### 2.1 COLORS AND FINISHES

- A. Manufacturer listed is for color only and the basis for matching color selection to other paint manufacturers specifically call out for a surface. All colors to be selected by the Architect or as indicated on drawings and specifications.
  1. Interior drywall and block walls: Gliddon "Basic Beige 45YY65/084"
  2. Exterior standard block walls: Gliddon "Basic Beige 45YY65/084"
  3. Interior and exterior door, door frames, window frames and louvers:

Gliddon "Toasty Grey 30YY51/098"

4. Exterior split face block and stucco: Gliddon "Toasty Grey 30YY51/098"
5. Dry wall ceilings: "White"
6. Primary and secondary exposed steel structure of pre-eng. Building paint color to match color of wall panel selected.

## 2.2 MATERIAL QUALITY

- A. Provide best quality grade of various types of coatings as regularly manufactured by PRATT & LAMBERT; DULUX PAINTS; PITTSBURGH PAINTS; GLIDDEN; SHERWIN WILLIAMS; DURON; Materials not displaying manufacturer's identification as a standard best-grade product will not be acceptable.
- B. Provide undercoat paint produced by same manufacturer as finish coats. Use only thinners approved by paint manufacturer and use only within recommended limits.
- C. Paint Systems: Provide the following paint systems for various substrate as indicated:

## 2.3 EXTERIOR PAINT SYSTEMS: Manufacturer listed name and system establishes base line for quality standard for the paint system required. Other paint manufacturer's products may be submitted for review by the Architect. The Contractor will submit all information to the Architect to determine whether proposed substitution meets the base line quality requirements.

### A. EXTERIOR SMOOTH CONCRETE BLOCK AND SPLIT FACE CMU.

1. One coat, Dulux Paints, Dulux Ultra Hide Blockaid No. 3110-1200.
2. Two coats, Dulux Paints, Decra-Flex Elastomeric coat system 2260-xxxx

### B. EXPOSED STEEL PRIMARY AND SECONDARY STRUCTURE:

1. Pratt & Lambert, spec.# 41.1, gloss finish, alkyd type, 1 coat Effecto Primer + 2 coats Effecto, or accepted equal.

## 2.4 INTERIOR PAINT SYSTEMS: Manufacturer listed name and system establishes base line for quality standard for the paint system required. Other paint manufacturer's products may be submitted for review by the Architect. The Contractor will submit all information to the Architect to determine whether proposed substitution meets the base line quality requirements.



A. INTERIOR DRYWALL SURFACES:

1. Pratt & Lambert, spec # 114.4, semi-gloss finish, latex enamel type, 2 coats Alcolate, or accepted equal.

B. INTERIOR CMU SURFACES:

1. Pratt & Lambert, spec # 118.4, satin finish, latex type, 1 coat primafill+2 coats Aqua Satin Enamel, or accepted equal.

C. NEW DRYWALL WET AREAS:

1. Pratt & Lambert, spec #114.5, satin finish, latex enamel type, 2 coats Aqua-Satin, or accepted equal.

D. DOORS AND FRAMES, WINDOW FRAMES:

1. Pratt & Lambert, spec.# 41.1, gloss finish, alkyd type, 1 coat Effecto Primer + 2 coats Effecto, or accepted equal.

E. STEEL PRIMER:

1. FEDERAL SPECIFICATION TT-P-636D, color & finish to match existing.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Applicator must examine areas and conditions under which painting work is to be applied and notify contractor in writing of conditions detrimental to proper and timely completion of work. Do not proceed with work until unsatisfactory conditions have been corrected in a manner acceptable to Applicator.
- B. Starting of painting work will be construed as Applicator's acceptance of surfaces and conditions within any particular area.
- C. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, un-cured masonry joints repaired and un-cured concrete allow manufacturers recommendation for cure or as listed on the drawings and these specification or any conditions otherwise detrimental to formation of a durable paint film.

3.2 SURFACE PREPARATION

- A. General: Perform preparation and cleaning procedures in accordance with paint manufacturer's instructions as herein specified and shown on drawings for each particular substrate condition.
- B. Remove hardware, hardware accessories, machined surfaces, plates, lighting fixtures, and similar items in place and not to be finish painted, or provide surface applied protection prior to surface preparation and painting operations. Remove, if necessary for complete painting of items and adjacent surfaces. following completion of painting of each space or area, reinstall removed items.
- C. Clean surfaces to be painted before applying paint or surface treatments. Remove oil and grease prior to mechanical cleaning. Program cleaning and painting so that contaminants from cleaning process will not fall onto wet, newly-painted surfaces.
- D. Cementitious Materials: Prepare cementitious surfaces of concrete, concrete block and cement plaster to be painted by removing efflorescence, chalk, dust, dirt, grease, oils, and by roughening as required to remove glaze.

### 3.3 TEST & SURFACE PREPARATION

- A. Determine alkalinity and moisture content of surfaces to be painted by performing appropriate tests. If surfaces are found to be sufficiently alkaline to cause blistering and burning of finish paint, correct this condition before application of paint. Do not paint over surfaces where moisture content or alkalinity exceeds that permitted in manufacturer's printed directions and recommendations. Submit 2 copies of alkalinity test and recommendation for Owner and Architect record.
- B. Determine paint origin on existing metal panels. Notify Architect if paint is not original factory applied paint.
- C. Clean existing concrete floor surfaces scheduled to be painted with a commercial solution of muriatic acid, or other etching cleaner. Flush floor with clean water to neutralize acid and allow to dry before painting. Do not use muriatic acid on the second floor of Building "A" or around any new or existing steel structure or hollow metal work. See drawings for instructions on floor preparation in those areas where muriatic acid can not be used.
- D. Wood: Clean wood surfaces to be painted of dirt, oil, or other foreign substances with scrapers, mineral spirits, and sandpaper, as required. Sandpaper smooth those finished surfaces exposed to view, and dust off. Scrape and clean small, dry, seasoned knots and apply a thin coat of white shellac or other recommended knot sealer before application of priming coat. After priming, fill holes and imperfections in finish surfaces with putty or plastic wood filler. Sandpaper smooth when dried.

- E. Prime, stain, or seal wood required to be job-painted immediately upon delivery to job. Prime edges, ends, faces, underside, and backsides of such wood, including cabinets, counters, cases and paneling.
- F. Seal tops, bottoms, and cut-outs of unprimed wood doors with a heavy coat of varnish or equivalent sealer immediately upon delivery to job.
- G. Ferrous Metals: Clean ferrous surfaces, which are not galvanized or shop coated of oil, grease, dirt, loose mill scale and other foreign substances as noted on drawings.
- H. Touch-up shop applied prime coats wherever damaged or bare where required by other sections of these specifications. Clean and touch-up with same type of shop primer.
- I. Galvanized Surfaces: Clean free of oil and surface contaminants. Treat surfaces for painting and priming follow paint manufacturer recommendations for treatment of the galvanized surfaces.

### 3.4 MATERIALS PREPARATION

- A. Mix and prepare painting materials in accordance with manufacturer's directions. 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 material and residue.
- B. 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.

### 3.5 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.
- B. Apply additional coats when undercoats stain 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.
- C. Paint surfaces behind moveable equipment and furniture same as similar exposed surfaces. Paint surfaces behind permanently fixed equipment or furniture similar exposed surfaces.

- D. Finish exterior doors on tops, bottoms and side edges same as exterior faces, unless otherwise indicated. Sand lightly between each succeeding enamel or varnish coat. Omit first coat (primer) on metal surfaces which have been shop-primed and touch-up painted, unless otherwise indicated.
- E. Scheduling Painting: Apply first coat material to surfaces that have been cleaned, pre-treated or otherwise prepared for painting by painter as soon as practicable after preparation and before subsequent surface deterioration.
- F. 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.
- G. Minimum Coating Thickness: Apply materials at not less than manufacturer's recommended spreading rate to establish a total dry film thickness as indicated or, if not indicated, as recommended by coating manufacturer.
- H. Mechanical and Electrical Work: Painting of mechanical and electrical work is limited to those items exposed and on the exterior of the building. Use paint primer and paint type that is compatible with the material being painted.
- I. Prime Coats: Apply prime coat of material which is required to be painted or finished, and which has not been primer coated by others.
- J. Re-coat primed and sealed surfaces where there is evidence of suction spots or unsealed areas of first coat, to assure a finish coat with no burn-through or other defects due to insufficient sealing.
- K. Pigmented (Opaque) 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.

### 3.6 CLEAN-UP AND PROTECTION

- A. Clean-Up: During progress of work, remove from site discarded paint materials, rubbish, cans and rags at end of each work day. Upon completion of painting work, clean window glass and other paint spattered surfaces. Remove spattered paint by proper methods of washing and scraping, using care not to scratch or otherwise damage finished surfaces.
- B. Protection: Protect work of other trades, whether to be painted or not, against damage by painting and finishing work. Correct any damage by cleaning, repairing or replacing, and repainting, as acceptable to Architect. Protect all existing exterior Landscaping or other adjacent property from

- damage from paint and the work.
- C. Cover floors of spaces scheduled for exposed concrete finish or other floor sealers with temporary protective cover.
  - D. Provide "wet paint" signs as required to protect newly painted finishes. Remove temporary protective wrappings provided by others for protection of their work after completion of painting operations. At the completion of work of other trades, touch-up and restore all damaged or defaced painted surfaces.

END SECTION 09900

## **SECTION 10200 - LOUVERS AND VENTS**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

- A. Extent of louvers and vents is indicated on drawings, including indications of sizes and locations.
- B. Sealants including installation are specified in Section 07920 Joint Sealants.
- C. See Mechanical and Electrical Specification Sections and drawings for fans and ducts attached to the louvers.

#### **1.2 SUMMARY**

- A. Types of louvers and vents include the following to the extent of extruded aluminum louvers to match the profile, function, appearance and finish as shown on the drawing and specification here in.
- B. Louver Assemblies furnished to include the following:
  - 1. Dade County protocols approved louvers.

#### **1.3 REFERENCES**

- A. Air Movement and Control Association International, Inc.
  - 1. AMCA Standard 500-L-99 Laboratory Methods of Testing Louvers for Rating
  - 2. AMCA Publication 501, Application Manual for Louvers
- B. The Aluminum Association Incorporated
  - 1. Aluminum Standards and Data
  - 2. Specifications and Guidelines for Aluminum Structures
- C. American Society of Civil Engineers
  - 1. Minimum Design Loads for Buildings and Other Structures
- D. American Society for Testing and Materials
  - 1. ASTM B209
  - 2. ASTM B211

3. ASTM B221
4. ASTM E90-90

E. Architectural Aluminum Manufacturers Association

1. AAMA 800 Voluntary Specifications and Test Methods for Sealants
2. AAMA 605.2 Voluntary Specifications for High Performance Organic Coating on Aluminum Extrusions and Panels
3. AAMA 2605-998 Superior performing Organic Coatings on Aluminum Extrusions and Panels

F. Dade County Protocols

1. PA 100(A)-95 Test Procedure for Wind and Wind Driven Rain Resistance and/or Increased Wind Speed Resistance of Soffit Ventilation Strip and Continuous or Intermittent Ventilation System Installed at Ridge Area
2. PA-201-95 Impact Test Procedure
3. PA-202-95 Criteria for Testing Impact and Non-Impact Resistant Building Envelope Components Using Uniform Static Air Pressure.
4. PA-203-95 Criteria for Testing products Subject to Cyclic Wind Pressure loading.

1.4 QUALITY ASSURANCE

- A. Performance Requirements: Where louvers are indicated to comply with specific performance requirements, provide units whose performance ratings have been determined in compliance with Air Movement and Control Association (AMCA) Standard 500.
- B. AMCA Certification: Where indicated, provide louvers with AMCA Publication 511 Rating Seal evidencing that product complies with above requirements.
- C. Comply with SMACNA "Architectural Sheet Metal Manual" recommendation for fabrication, construction details and installation procedures except as otherwise indicated.
- D. The louvers shall have Miami-Dade county product notice of acceptance.
- E. Shop Assembly: Coordinate field measurements and shop drawings with fabrication and ship assembly of units. Preassemble units in shop to greatest extent possible and disassemble as necessary for shipping handling limitations and field installation. Clearly mark units for reassembly and coordinated installation.

## 1.5 SUBMITTALS

- A. As per Section 01300. Provide 6 copies as follows.
- B. Product data: Submit manufacturer's specifications; certified test data, where applicable; and installation instructions for required products, including finishes.
- C. Shop Drawings: Submit 6" square samples of each required finish. Prepare samples on metal of the same gage and alloy to be used in the work. Where normal color and texture variations are to be expected, include 2 or more units in each sample showing limits of such variations.
- D. Product Acceptance: Miami-Dade approved acceptance certificate for each unit.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Construction Specialties, Inc.  
49 Meeker Ave.  
Cranford, New Jersey 07016  
(800) 631-7395
- C. Or approved equal.

### 2.2 PRODUCT

- A. Construction Specialties, Inc. basis of design or approved equal

- 1. Series 7000 Aluminum Louvers, 7034/A4080  
NOA No. 12-0308.28

Office building louvers: horizontal fixed blades outside and operable blades on the interior side.

Garage building louvers: vertical fixed blades outside.

### 2.3 MATERIALS

- A. Frame: aluminum .081", drainable blades.
- B. Blades: 6063T5 extruded aluminum



- C. Screen:  $\frac{3}{4}$ " x.051" expanded, flattened aluminum bird screen in removable frame.
- D. Finish: Anodized clear anodize 215R1 Architectural Class I Anodic Coating per ASTM B244-68 and ASTM B136-77.
- E. Anchors and Inserts: Use non-ferrous metal or stainless steel anchors and inserts for exterior installations and elsewhere as required for corrosion resistance. Use stainless steel expansion bolt devices for drilled-place anchors. Furnish inserts, as required to be set into concrete or masonry work. Use fasteners compatible with adjacent materials.
- F. Bituminous Paint: SSPC-Paint 12 (cold-applied mastic).

### 2.3 FABRICATION, GENERAL

- A. Provide louvers and accessories of design, materials, sizes, depth, arrangement, and metal thicknesses indicated or if not indicated, as required for optimum performance with respect to airflow; water penetration; air leakage where applicable (for adjustable units, if any); strengths; durability; and uniform appearance.
- B. Fabricate frames including integral sills to suit adjacent construction with tolerances for installation including application of sealants in joints between louvers and adjoining work.
- C. Include support, anchorages, and accessories required for complete assembly. Provide and install additional aluminum channels, angles, girts to span the opening.
- D. Provide sill extensions and loose sills made of the same materials as the louver, where indicated, or required for drainage to exterior and to prevent water penetrating to interior.
- E. Join frame members to one another and to stationary louver blades by welding, except where indicated otherwise or where necessary by size of louvers. Maintain equal blade spacing including separation between blades and frames at head and still to produce uniform appearance.
- F. Provide additional structural aluminum framing as indicated on the drawings.
- G. Furnish units complying with following performance requirements:
  - 1. Free Area: Not less than 50% on a 48"x48" size louver or as indicated on the drawing.
  - 2. AMCCA Certification: Furnish units bearing AMCA Certified Ratings Seal.

3. Miami-Dade County notice of acceptance certificate.
- H. Louver Screens: Provide removable screens for louvers.
    - I. Fabricate screen frames of same metal and finish as louver units to which secured, unless otherwise indicated. Provide rewireable frames consisting of formed or extruded metal with a driven spline or insert for securing screen mesh. Use insect screens where indicated of 0.011" aluminum wire. Use bird screens where indicated of 1/2" square mesh, 0.063" aluminum wire. Locate screens on the inside face of louvers. Secure screens to louvers frames with machine screws, spaced at each corner and at 12" o.c. between.
    - J. Metal Finishes: General: Comply with NAAMM "Metal Finishes Manual" for finish designations and applications recommendations, except as otherwise indicated. Apply finishes in factory after products are assembled. Protect finishes on exposed surfaces with protective covering, prior to shipment. Remove scratches and blemishes from exposed surfaces which will be visible after completing finishing process. Finish of all louvers exposed to exterior view are to be of color to match frames.
    - K. Ferrous Metal Finishes: Preparation: clean surfaces of dirt, grease and loose rust or mill scale, including items fabricated from galvanized steel, if any. Apply finish to surfaces of fabricated and assembled units, where exposed or concealed when installed, after pretreating with a conversion coating suited to organic coating applied over it.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Coordinate setting drawings, diagrams, templates, instructions and directions for installation of anchorages which are to be embedded in concrete or masonry construction. Coordinate delivery of such items to project site.

### 3.2 INSTALLATION

- A. Locate and place louver units plumb, level and in proper alignment with adjacent work.
- B. Use concealed anchorage wherever possible. Provide brass or lead washers fitted to screws where required to protect metal surfaces and to make a weathertight connection.
- C. Form tight joints with exposed connections accurately fitted together. Provide reveals and openings for sealants and joint fillers, as indicated.

- D. Repair finishes damage by cutting, welding, soldering and grinding operations required for fitting and jointing. Restore finishes so there is no evidence of corrective work. Return items which cannot be refinished in the field to shop make required alternations, and refinish entire unit, or provide new units, at Contractor's option.
- E. Protect galvanized and non-ferrous metals surfaces from corrosion or galvanic action by application of heavy coating of bituminous paint on surfaces which will be in contact with concrete, masonry or dissimilar metals.
- F. Provide concealed gaskets, flashings joints fillers, and insulations, and install as work progresses to make the installations weathertight.
- G. Refer to Division 7 section for sealants in connection with installations of louvers.
- H. Provide and install 1/16" thick Anodized Aluminum '2' Flashing with soldered vertical sides (3 sides) and drip to exterior for louver/damper drainage.

END SECTION 10200

## **SECTION 10350 - FLAG POLES**

### **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 flag pole as shown on Drawings and as specified herein.

#### **1.3 SUBMITTALS**

A. Manufacturers data and shop drawings showing all grounding, mounting, and construction details of all flag pole components. Submittals must include a Letter of Certification that it meets the wind loading requirements.

#### **1.4 GUARANTEE**

A. Per General Conditions.

### **PART 2 - PRODUCTS**

#### **2.1 MANUFACTURER**

A. Concord Industries (800) 527-3902

B. Ewing, (800) 633-7653

C. Pole-Tech (800) 633-6733

#### **2.2 PRODUCTS**

A. Pro-Tech, PT256C, cone tapered aluminum, ground set. Clear anodized.

B. Aluminum, flagpole, ASTM B241, Alloy 6063-T6.

C. Base and anchors devices and accessories.

D. 25' exposed height, 6" butt.

E. Ball, aluminum, gold anodized, 14 ga.

F. Hayyard, 5/16 dia (#10) braided, nylon rope.

- G. Cleat - One 9"
- H. American Flag 3'x 5"
- I. Install positive lightning ground wire and rod concealed.
- J. 120 mph wind speed.

### 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 metal locker installation for placing of all required filed cells for anchoring 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 flagpole as per manufacturer's published instructions and accepted installation layouts.

#### 3.5 CLEAN-UP

- A. Per General Conditions.

END SECTION 10350

## **SECTION 10420 - PLAQUE**

### **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 Plaques as shown on Drawings and as specified herein.

B. Owner will supply final graphic for county seal.

C. Owner will supply a final list of commissioners.

#### **1.3 SAMPLES**

A. Per General Conditions, submit two samples of color selected and hardware for acceptance by Architect.

#### **1.4 GUARANTEE**

A. Per General Conditions.

#### **1.5 SUBMITTAL**

A. Submit Shop Drawings, manufacturer data.

### **PART 2 - PRODUCTS**

#### **2.1 MANUFACTUER**

A. Ramos, Architectural Signage Systems (405) 235-5505

B. Metal Arts, (800) 237-8069

C. OMC Industries, Inc., (800) 488-4662, or accepted equal.

D. Accepted Equal.

#### **2.2 BUILDING PLAQUE**

A. Sign type model I-89.

B. Bronze 24" x 18"

C. Standard raised letters

D. Manufacturers:

1. A.R.K. Ramos Architectural Border, BR-400 background.
2. Gemini Plaques
3. Or approved equal.

E. Sign to list the following:

1. Name of Project
2. Orange County Board Chairman
3. Orange County Board of County Commissioners List
4. Year of Construction
5. Name of Architectural Firm
6. Name of General Contractor

F. Beveled edge

G. Surface mounted blind mount.

H. Lettering "Times Roman"

### 2.3 COUNTY SEAL

- A. 36" diameter custom bronze. Alloy 220 Commercial, Bronze background with raised seal, border and letters in BLACK.
- B. Surface mounted blind mount. Type A.
- C. Use latest official adopted graphics for County Seal. Owner will provide the official graphic artwork.

### 2.4 BUILDING ADDRESS NUMBERS FOR EACH BUILDING

- A. Injection molded plastic - color black.
- B. 6" high
- C. Style "Roman"

D. 6 numbers for each building

### 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 plaque installation for placing of all required blocking, subframing, backing, furring, filled cells etc., to insure proper locations. Surface attachment.

#### 3.3 DELIVERY AND STORAGE

A. Deliver and store materials in dry, protected areas. Keep free of corrosion or other damage. Replace any damaged plaque at no cost to Owner.

#### 3.4 INSTALLATION

A. Install all plaque as per manufacturer's published instructions and accepted installation layouts. Provide and size all templates for proper coordination and placement of anchor in masonry walls.

#### 3.5 CLEAN-UP

A. Per General Conditions.

END SECTION 10420



## **SECTION 10520 - FIRE EXTINGUISHERS**

### **PART 1 - GENERAL**

#### **1.1 DESCRIPTION**

- A. The work included under this Section includes labor, materials, equipment and services necessary to complete the fire extinguishers as herein specified.

#### **1.2 SUBMITTALS**

- A. See Section 01300 "Submittals"
- B. Submit 10 copies of product literature and mounting information.

### **PART 2 - PRODUCTS**

#### **2.1 MATERIALS**

- A. Provide surface mounted multi-purpose dry chemical fire extinguishers as shown on drawing and as directed and approved by Local Fire Marshal.
- B. Locations & Quantity:
  - OFFICE BLDG (1)
  - MAINTENANCE/GARAGE (8)
  - FUEL ISLAND (1)
  - STORAGE BUILDING (2)
- C. The Fire Marshall shall make final determination for type and location of fire extinguishers as per NFPA. If the Fire Marshall does not set minimum standard for quantity, type, size or locations, provide extinguisher as listed above.
- D. Provide all mounting hardware surface mounted except as noted.
- E. Provide surface mounted water resistant cabinet at fuel island.
- F. Provide reflective sticker on locator decals at each face of the steel col. at the garage building, fuel island and storage building. Install one decal above extinguisher at the office.

### **PART 3 - EXECUTION**

#### **3.1 INSTALLATION**

- A. Install brackets, cabinet, reflective decals. as per manufacturer's

recommendations. Provide solid blocking in stud wall for mounting. Provide appropriate fasteners for each wall condition and load.

END SECTION 10520

## **SECTION 10530 - PRE-ENGINEERED ALUMINUM CANOPIES**

### **PART 1 - GENERAL**

#### **1.0 SUMMARY**

- A. To the extent shown on drawings and specified herein.

#### **1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the contract including general and supplementary conditions, and Division 1 Specification Sections apply to the work specified in this section.

#### **1.2 REFERENCES**

- 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.
  - 1. AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)  
ASTM-B449.
  - 2. ALUMINUM ASSOCIATION (AA) - AA-M10-C22-A21 - Satin etched  
and clear anodized.
  - 3. QUALITY STANDARDS FOR PAINTED SHEET ALUMINUM  
ASSOCIATION
  - 4. AMERICAN SOCIETY OF CIVIL ENGINEERS - ASCE PAPER  
#3342
  - 5. MILITARY SPECIFICATIONS (MIL) - MIL-125-880

#### **1.3 SUBMITTALS**

- A. Submit the following in accordance with Section 01300, "Submittals".
  - 1. Data: Submit 10 sets of design calculations prepared by a registered Structural Engineer. Provide all documents signed and sealed by a Florida Registered Structural Engineer.
  - 2. Manufacturer's Catalog Data: Standard Sections.
  - 3. Drawings: Submit 10 sets of complete engineered drawings signed and sealed by a Florida Registered Structural Engineer showing layout, member sizes and details.

4. Instructions:
  - a. Installation instructions.
  - b. Storage instructions.
  - c. Special precautions.
5. Statements
  - a. Qualifications of installer.
6. Certificates
  - a. Statement from manufacturer attesting to quality of materials to be used and methods of fabrication.
7. Samples
  - a. Columns.
  - b. Beams.
  - c. Deck.
  - d. Fascia.
  - e. Flashing.
8. Color Samples
  - a. Samples of specified color.
9. Operation and Maintenance
  - a. Surface material maintenance and cleaning.

#### 1.4 DELIVERY, STORAGE AND HANDLING

- A Delivery: Deliver materials in the original packages, containers, or bundles with each bearing the manufacturer's name, applicable standard designation, and name of supplier.
- B. Storage: Keep material dry by storing off the ground, properly supported on a level platform, and protected from exposure to the elements.

- C. Handling: Neatly store material to prevent denting, sagging, or damage to edges and coated surfaces.

## 1.5 LOADS

- A. Wind loads and uplift pressures, See Structural drawings for Load Criteria.
- B. Live and dead load per Florida Building Code, 2010.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. Aluminum - 6063 alloy heat treated to a T-6 temper.
- B. Fasteners - 18-8 stainless steel with sealed neoprene "O" rings.

### 2.2 ISOLATION

- A. Coat all columns that are in contact with concrete or grout with clear acrylic enamel to prevent electrolyc reaction.

### 2.3 COATING

- A. AA-M10-C22-A21
- B. AA-M10-C22-A44

### 2.4 FINISH

- A. Columns, beams, fascia and roof to be standard manufacturer's color "anodized clear aluminum".

### 2.5 MANUFACTURER'S STANDARDS

- A. Ditt Deck, Ditt Mer Architectural Aluminum, 1006 Shepard Road, Winter Springs, Florida 32708.
- B. Royal Aluminum, Leesburg, Florida.
- C. Architectural Metal Systems, P.O. Box 550625, Orlando, Florida 32805.
- D. E.L. Burns Co. Inc., P.O. Box 19160, Shreveport, LA 71148.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Install items at locations indicated, according to manufacturer's instructions.

### 3.2 COORDINATION

- A. Coordinate with other trades for sequence of installation of entrance canopies.

### 3.3 ANCHORAGE, FASTENINGS, AND CONNECTIONS

- A. Provide anchorage where necessary for fastening miscellaneous metal items securely in place. Include for anchorage not otherwise specified or indicated slotted inserts, expansion shields, and power-driven fasteners, when approved for concrete; toggle bolts and through bolts for masonry; machine and carriage bolts for steel; through bolts, lag bolts, and screws for wood. Do not use wood plugs in any material. Provide non-ferrous attachments for non-ferrous metal. Make exposed fastenings of compatible materials, generally matching in color and finish, to which fastenings are applied. Conceal fastenings where practicable.
- B. Provide and install matching break metal to flash gap between canopy and building.

### 3.4 BUILT-IN WORK

- A. Form for anchorage metal work built-in concrete. Provide and install sleeves and block-outs. Furnish metal work in ample time for securing in place as the work progresses. Provide templates for all anchorage of the work into concrete.
- B. Install columns and gutters prior to any masonry wall or cap slab installation.

### 3.5 FINISHES

- A. Dissimilar Materials: Where dissimilar metals, as defined by MIL-STD-889 are in contact, or where aluminum is in contact with concrete, mortar, masonry, wood or absorptive materials subject to wetting, protect surfaces with a coat conforming to FS-TT-P-664 to prevent galvanic or corrosive action.

1. Alkyd is not to be used on metal in contact with concrete or masonry.
  - B. Environmental Conditions: Do not clean or paint surface when damp or exposed to foggy or rainy weather, when metallic surface temperature is less than 5 degrees F. above the dew point of the surrounding air, or when surface temperature is below 45 degrees F. or over 95 degrees F., unless approved by the Contracting Officer.
- 3.6 PROTECTION
- A. Protect surfaces from damage. Replace damaged sections.
- 3.7 CLEANING
- A. Upon completion of work, clean exposed surfaces of the canopy thoroughly with a canopy manufacturer approved cleanser. Provide minor touch-up paint.

END SECTION 10530

## **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. Bench
- 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. Benches and Pedestals (Republic) or accepted equal

1. Pedestals 17-1/2" high x 1-1/4 o.d. tubing with 10 guage steel flanges secured to floor.
2. 1-1/4" x 9-1/2" x 36" laminated maple bench.

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 10800 - TOILET ACCESSORIES**

### **PART 1 - GENERAL**

#### **1.1 DESCRIPTION**

- A. The work included under this Section includes all labor, materials, equipment and services necessary to complete the toilet accessories as herein specified.

#### **1.2 QUALITY ASSURANCE**

- A. Provide products of the same manufacturer for all accessory units except as specified otherwise. Stamped names and labels will not be permitted except as specified otherwise. Locked dispensing units shall be keyed alike for all accessories.

#### **1.3 SUBMITTAL**

- A. Provide accessories Schedule.
- B. Manufacturer's Product literature.

### **PART 2 - PRODUCTS**

#### **2.1 PRODUCTS**

- A. Provide items shown on drawings and scheduled in the specifications. Provide all misc. accessories inserts, plates, connectors for a complete installation of toilet accessories; coordinate with plan for specific wall types and substrates the accessories will be attached to and provide misc. items required for that type of wall complete.

#### **2.2 MANUFACTURER**

- A. Toilet Accessories & Mirrors
  - 1. Bradley
  - 2. Bobrick Washroom Equipment, Inc.
  - 3. American
  - 4. Metpar Corp. 516-333-2600

#### **2.3 PARTITIONS**

- 1. Doors 22 GA Stainless Steel type 304. Panels 22 GA Stainless Steel type 304. Pilasters 20 GA Stainless Steel type 304.

### **PART 3 - EXECUTION**

### 3.1 INSTALLATION:

- A. The accessory manufacturer's mounting details shall be coordinated with other trades as their work progresses.
- B. Surfaces of fastening devices exposed after installation shall have the same finish as the attached accessory.
- C. Use concealed fastenings wherever possible.
- D. Provide anchors, bolts and other necessary fasteners, and attach accessories securely to walls and partitions in locations as shown or directed. Use manufacturers fasteners required for the type of wall shown on the drawings.
- E. Provide theft-resistant fasteners for all accessory mountings.
- F. Secure toilet room accessories to adjacent walls and partitions complying with the manufacturer's instructions for each item and each type of substrate construction.
- G. Mounting height shall meet minimum and maximum, State official ADA requirements.
- H. Installed location and height of accessories shall be approximately as indicated on drawings.

END SECTION 10800

## **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.

## 2.3 COLOR

- A. Almond/Beige- Residential appliances
- B. Stainless Steel- Ice Cube Machine

## 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 12510 - VENETIAN BLINDS**

### **PART 1 - GENERAL**

#### **1.1 SUMMARY**

- A. Provide and install Venetian Blinds as follows: At every interior and exterior window of the office building.

#### **1.2 REFERENCES**

- 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.

#### **FEDERAL SPECIFICATIONS (FS)**

FS AA-V-00200

(Rev. B) Venetian Blinds

#### **1.3 SUBMITTALS**

- A. Submit the following in accordance with Section 01300, "Submittals."
- B. Manufacturer's Catalog Data: Blinds
- C. Manufacturer's Standard Color Charts: Blinds, color to be "Beige".
- D. Drawings: Blind details. Submit sufficient detail to verify installation method and compliance with requirements. Submit a numbering plan for identification of each blind with the proper installation location.
- E. Samples: Submit one complete unit of each type specified labeled for identification. Deliver approved samples to the site; if in good condition and otherwise suitable, the samples may be installed in the work. Identification and approval marks shall remain undisturbed until final acceptance. Colors shall be as specified in paragraph entitled "Colors for Slats, Tape, Cords, and Exposed Metal."

#### **1.4 DELIVERY AND STORAGE**

- A. Deliver the blinds to the site in the manufacturer's original containers with the manufacturer's name and container contents clearly labeled. Store in a safe, dry, clean, and well-ventilated area. Do not open containers until needed for installation unless verification inspection is required.

### **PART 2 - PRODUCTS**

## 2.1 BLINDS

- A. Blind Units: FS AA-V-00200, Type II, one-inch slats, except as modified herein.
- B. Size: Lengths and widths as required for installation between the jambs.
- C. Slats: Aluminum for Type II venetian blinds.
- D. Cords; Braided nylon, ends heat-fused, and terminated with a plastic tassel.
- E. Tilting Device: Locate on the right side.
- F. Lifting Cord Locks: Locate on the side opposite the tilting device enabling the blind to stop at any height.
- G. Color for Slats, Tape, Cords, and Exposed Metal: One color to be selected by the Architect.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Install blinds after the work of other trades, including painting, is substantially done. Install blinds level and in accordance with manufacturer's recommended installation instructions as approved. Use suitable type and size fasteners for the application. Isolate metal parts from direct contact with concrete, mortar, or dissimilar metals. Ensure blinds installed in recessed pockets can be removable without disturbing the pocket. The entire blind, when retracted, shall be contained behind the pocket. For blinds installed outside the jambs and mullions, overlap each jamb and mullion 0.75-inch (19.05mm) or more when the jamb and mullion sizes permit. Include all hardware, brackets, anchors, fasteners and accessories necessary for a complete, finished installation.

END SECTION 12510



## **SECTION 13120 - PRE-ENGINEERED STRUCTURES**

### **PART 1- GENERAL**

#### **1.1 RELATED DOCUMENTS**

- A. The General Provisions of the Contract, including General and Supplementary Conditions and General Requirements, apply to work specified in this Section.

#### **1.2 DESCRIPTION OF THE WORK**

- A. The extent of the work shall include The Maintenance/Garage building, Fuel Island and the Roof of The Office building. The design shall meet the standards set by the latest edition of the Florida Building Code for pre-engineered metal structures, and contract documents (drawings and specifications).
- B. See structural drawing for required loading and wind pressures required for design of structure and components of cladding.

#### **1.3 QUALITY ASSURANCE**

- A. Provide pre-engineered building components from a single building manufacturer for the Maintenance/Garage building, Storage Building and Fuel Island. Refer to drawings.

#### **1.4 SUBMITTAL**

- A. As per Section 01300 provide fully engineered drawings and calculations signed and sealed by a P.E. registered in the State of Florida. The structural design shall include but not limited to all components including point load super imposed by the hoist, mechanical and electrical equipment.
  - 1. Submit 12 sets of signed, sealed drawings and calculations of which 6 shall be used for the Building Department for permits.
- B. Product data consisting of metal building structural framing system, roofing and siding panels, and other metal building components.
- C. Provide complete erection drawing prepared under the direction of a Florida Registered Professional Engineer. Include details showing fabrication and assembly of the metal building system. Show anchor bolt settings, reactions end-wall and roof framing. Include transverse cross-sections.
- D. Roofing and Siding Panels: Provide layouts of panels on walls and roofs,

details of edge conditions, joints, corners, custom profiles, supports, anchorages, trim, flashings, closures, and special details. Include transverse cross-sections.

- E. Building Accessory Components: Provide details of metal building accessory components to clearly indicate methods of installation including the following:
1. Personnel doors: Provide elevations and details of each type of door and requirements for finish hardware. Provide schedule of doors and frames using the same reference numbers for details and openings as those indicated on the drawings; include complete hardware schedule.
  2. Aluminum Louvers: Provide ¼-inch scale elevations of louver units and not less than ¾-inch scale details showing anchors, hardware, and flashing details.
  3. Sheet Metal Accessories: Provide layouts at ¼-inch scale. Provide details of ventilators, louvers, gutters, downspouts, and other sheet metal accessories at not less than 1-1/2-inch scale showing profiles, methods of joining, and anchorages.
  4. All building accessory components will have wind rated assemblies which comply and are installed per Miami/Dade County Approval System or the Florida Building Code Approval System.
- F. Samples for initial selection purposes in form of manufacturer's color charts or chips showing full range of colors, textures, and patterns available for metal roofing and siding panels with factory-applied finishes.
- G. Samples for verification purposes of roofing and siding panels. Provide sample panels 12-inch long by actual panel width, in the profile, style, color, and texture indicated. Include clips, battens, fasteners, closures, and other panel accessories.
- H. Installer certificates signed by metal building manufacturer written certification certifying that the installer complies with requirements included under the "Quality Assurance" Article.
- I. Professional Engineer's certificate prepared and signed by a Professional Engineer, legally authorized to practice in the jurisdiction where project is located, verifying that the structural framing and covering panels meet indicated loading requirements and codes of authorities having jurisdiction.

## 1.5 DESIGN

### A. Design Authorities:

1. Structural Steel: All Structural Steel sections and welded plate members shall be designed in accordance with the allowable stresses and design requirement sections of the latest edition of the "A.I.S.C.

Manual of Steel Construction".

2. Cold-Formed: All Cold-Formed members including exterior covering shall be designed in accordance with the allowable stresses and design requirement sections of the latest edition of "The A.I.S.I. Cold-Formed Steel Design Manual".

## 1.6 DESIGN LOADS

- A. Wind and Live Loads: Loads shall be applied in accordance to the more stringent of requirements set forth by the "Florida Building Code 2010" requirements latest edition and load criteria set in the Structural drawings.
- B. Dead Loads: Dead loads shall be the weight of the structure, plumbing, mechanical systems, electrical and lighting systems, finishes, roof, insulation, hoist and miscellaneous loads. Include dead load required by the Florida Building Code 2010 and criteria load listed in structural drawings.

## 1.7 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an experienced Installer to erect the pre-engineered metal building who has specialized in the erection and installation of types of metal buildings systems similar to that required for this project and who is certified in writing by the metal building system manufacturer as qualified for erection of the manufacturer's products.
- B. Manufacturer's Qualifications: Provide pre-engineered metal buildings manufactured by a firm experienced in manufacturing metal buildings systems that are similar to those indicated for this project and have a record of successful in-service performance.
- C. Single-Source Responsibility: Obtain the metal building system components, including structural framing, wall and roof covering, and accessory components, from one source from a single manufacturer.
- D. Design Criteria: The drawings indicate sizes, profiles, and dimensional requirements of the pre-engineered metal building system. Metal building systems having equal performance characteristics with deviations from indicated dimensions and profiles may be considered, provided deviations do not change the design concept or intended performance. The burden of proof for equality is on the proposer.
- E. Design Criteria: The drawings indicate size, profiles, and dimensional requirements of the pre-engineered metal buildings and are based on the specific type and model indicated. Metal building systems having equal characteristics by other manufacturers may be considered provided that deviations in dimensions and profiles are minor and do not change the design concept or intended performance as judged by the Architect. The burden of

proof of equality is on the proposer.

## 1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver prefabricated components, sheets, panels, and other manufactured items so they will not be damaged or deformed. Package wall and roof panels for protection against transportation damage.
- B. Handling: Exercise care in unloading, storing, and erecting wall and roof covering panels to prevent bending, warping, twisting, and surface damage.
- C. Stack materials on platforms or pallets, covered with tarpaulins or other suitable weathertight ventilated covering. Store metal wall and roof panels so that water accumulations will drain freely. Do not store panels in contact with other materials that might cause staining, denting or other surface damage.

## 1.9 WARRANTY

- A. Roofing and Siding Panel Finish Warranty: Furnish the roofing and siding panel manufacturer's written warranty, covering failure of the factory-applied exterior finish on metal wall and roof panels within the warranty period. This warranty shall be in addition to and not a limitation of other rights the Owner may have against the Contractor under the Contract Documents.
  - 1. Warranty period for factory-applied exterior finishes on wall and roof panels is 20 years after the date of Substantial Completion.

## 1.10 EXTRA MATERIALS

- A. Maintenance Stock: Furnish at least 5 percent excess over required amount of nuts, bolts, screws, washers, wall panels, trim, fascias, and other required fasteners for each metal building. Pack in cartons labeled to identify the contents and store on the site where directed.

## PART 2- PRODUCT

### 2.1 MANUFACTURERS

- D. Maintenance Building and Roof of Office Building. Available Manufacturers: Subject to compliance with requirements, manufacturers offering metal building systems that may be incorporated in the work include but are not limited to the following:
  - 1. A&M Building Systems, Inc.
  - 2. A&S Building Systems, Inc.
  - 3. American Buildings Co.
  - 4. American Steel Building Co., Inc.

5. Butler Manufacturing Co.
6. Ceco Buildings Division
7. Gulf States Manufacturers, Inc.
8. Kirby Building Systems, Inc.
9. Mesco Metal Buildings Corp.
10. Star Buildings Systems
11. Varco-Pruden Buildings
12. Whirlwind Steel Buildings, Inc.

## 2.2 LOAD COMBINATIONS

- A. The design load combinations for all buildings shall be the most stringent of the following specified by the "Florida Building Code ",2010 latest edition and design criteria load in structural drawings.

## 2.3 ANCHOR BOLTS

- A. Anchor bolts shall be sized to resist all shears and uplifts induced by the structure and shall not be less than the sizes and quantities shown by the metal building manufacturer. All anchor bolts shall be unpainted to bond to the concrete and shall be set in strict accordance with the metal building manufacturer's drawings. See Structural and Architectural drawings.

## 2.4 MATERIALS

### 2.4.1. PRIMARY FRAMING STEEL

- A. Steel for hot-rolled structural sections shall conform to the requirements of ASTM specification A-36.
- B. Steel for all built-up sections shall meet as applicable the physical and chemical properties of ASTM A572 modified to 55,000 psi minimum yield and 70,000 psi minimum tensile strength, or ASTM A607, Grade 55, or ASTM A 570, Grade 55. Steel for all end wall "C" sections shall meet the physical and chemical properties of ASTM A 570, Grade 55.

### 2.4.2 SECONDARY FRAMING STEEL

- A. Steel used to form purlins, girts , eave struts and "C" sections shall meet the physical and chemical properties of ASTM A 570, Grade 55.

### 2.4.3 ROOF PANEL MATERIAL

- A. Roof for Maintenance Garage building, and Storage Building:
  1. Standing Seam
  2. 22 gauge, Grade D, aluminum-zinc alloy-coated steel, coating

designation, galvanized, pre-painted white as manufactured by Bethlehem, ASTM A792 sheet coating 55% aluminum, 43.4% zinc, 1.6% silicon nominal percentage by weight. Roof design base on Florida Building Code 2010 wind load requirement but no less than 22 gauge material.

B. Roof for Fuel Canopy:

1. Standing Seam
2. 20 gauge, Grade D, aluminum-zinc alloy-coated steel, coating designation, galvanize, pre-painted white as manufactured by Bethlehem, ASTM A792, coating 55% alum, 43.4 zinc, 1.6% silicone nominal percentage by weight.

C. Fasteners:

1. Clips: 16-guage panel clips.
2. Cleats: Factory-caulked, mechanically seamed cleats formed from 24-gauge, Grade C, zinc coated steel sheets.

- C. All roofing components, fasteners, and connections will have wind rated assemblies which comply and are installed as per approved engineered shop drawings.

#### 2.4.4 SIDING PANELS

- A. All materials and assemblies shall comply with the FBC wind pressures for cladding. Provide certified engineered lab test which shows compliance. See structural drawing for wind pressure and load required for compliance.
- B. Face Sheets: fabricate wall and roof panel face sheets to the profile or configuration indicated from 24-gage, structural quality, Grade D, zinc-coated steel sheets.
- C. Fasteners: Self-tappings screws, bolts, nuts, self-locking rivets, self-locking bolts, end-welded studs, and other suitable fasteners designed to withstand design loads.
1. Provide metal-backed neoprene washers under heads of fasteners bearing on weather side of panels.
  2. Use aluminum or stainless steel fasteners for exterior application and galvanized or cadmium-plated fasteners for interior applications.
  3. Locate and space fastenings in true vertical and horizontal alignment. Use proper tools to obtain controlled uniform compression for positive seal without rupture of neoprene washer.
  4. Provide fasteners with heads matching color of roofing or siding sheets by means of plastic caps or factory applied coating.

D. Accessories: Provide the following sheet metal accessories factory-formed of the same material in the same finish as roof and wall panels:

1. Flashings
2. Closers
3. Fillers
4. Ridge covers
5. Fascias

E. Flexible Closure Strips: Closed-cell, expanded cellular rubber, self-extinguishing flexible closure strips. Cut or premold to match configuration of roofing and siding sheets. Provide closure strips where indicated or necessary to ensure weathertight construction.

F. Sealing Tape: pressure-sensitive 100 percent solids grey polyisobutylene compound sealing tape with release paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape ½ inch wide and 1/8 inch thick.

G. Joint Sealant: One-part elastomeric polyurethane, polysulfide, or silicone rubber sealant as recommended by the building manufacturer.

H. Fluoropolymer Finish: Provide shop-applied fluoropolymer finish to galvanized steel roofing and siding panels and related trim and accessory elements.

1. Clean galvanized steel with an alkaline compound, then treat with a zinc phosphate conversion coating and seal with a chromic acid rinse.
2. Apply a 2-coat fluoropolymer coating system to pretreated steel. Coating shall consist of a specially formulated inhibitive primer applied to a dry film thickness of 0.15 mil to 0.25 mil and a fluorocarbon color coat containing not less than 70 percent polyvinylidene fluoride resin by weight applied to a dry film thickness of 0.80 mils to 1.3 mils.

a. Color: As selected by the Architect from the manufacturer's standard colors.

- I. All roofing components, fasteners, and connections will have wind rated assemblies which comply and are installed as per Miami/Dade County Approval System or the Florida Building Code Approval System

#### 2.4.5 Other Materials:

A. Bolts for Structural Framing: Comply with ASTM A 307 or ASTM A 325 as necessary for design loads and connection details.

B. Sealant Materials Provide:

1. Silicone Sealant: Single-component elastomeric silicone sealant complying with FS TT-S-001543, Class A, nonsag, and ASTM C 920, Type S, Grade NS, Class 25, Uses G, A, and O. Provide low modulus nonacid curing type, except use acid type if channel surfaces are porous.
  2. Polysulfide Sealant: 2-component elastomeric polysulfide sealant complying with FS TT-S-00227, Class A, Type2, and ASTM C 920, Type M, Grade NS, Class 25, Uses G, A, and O, as applicable.
  3. Acrylic Sealant: Single-component acrylic terpolymer or polypropenatate solvent-based thermo-plastic sealant complying with FS 55-2-00230, Class B, Type II, and ASTM C 920, Type S, Grade NS, Class 12-1/2, Uses G, A, and O, as applicable.
  4. Filler Rods: Compressible closed-cell or waterproof-jacketed rod stock of flexible and resilient synthetic rubber or plastic foam with 5-10 psi compression strength for 25 percent deflection.
- C. Thermal Insulation; Glass fiber blanket insulation, complying with ASTM C 991, of 0.5 lb per cu. ft. density, thickness as indicated, with UL flame spread classification of 25 or less, and 2 inch wide continuous vapor-tight edge tabs.
1. Vapor Barrier: Vinyl film.
  2. Retainer Strips: 26-gage (0.0179-inch) formed galvanized steel retainer clips colored to match the insulation facing.

#### 2.4.6 Paint and Coating Materials:

- A. Comply with performance requirements of the federal specifications indicated. Unless specifically indicated otherwise, compliance with compositional requirements of federal specifications indicated is not required.
1. Shop Primer for Ferrous Metal: Fast-curing, lead-free, universal primer, selected by the manufacturer for resistance to normal atmospheric corrosion, compatibility with finish paint systems, and capability to provide a sound foundation for field-applied topcoats despite prolonged exposure. Comply with FS TT-P-636D.
  2. Pre-painted galvalume panel.
    - a. Roof Panels
    - b. Wal Panels

#### 2.4.7 Rod:

- A. All rod used as structural bracing shall have a minimum yield strength of 36,000 psi.

#### 2.4.8 High Strength Bolts:



- A. All bolts used in primary structural connections shall be zinc plated high strength (ASTM A-325) bolts with a yellow dichromate dip.

#### 2.4.9 Standard Bolts:

- A. All bolts used in secondary structural connections shall be standard zinc plated machine bolts (ASTM A-307, Grade 2).

#### 2.4.10 Wind Bracing:

- A. Wind bracing shall be as shown on the building manufacturer's erection drawings and shall be accomplished by diagonal, rod bracing, steel column or other means necessary to satisfy roof and wall wind loads. All diagonal wind bracing shall include necessary hillside washers and adjustment nuts at each end. Do not use diagonal rod bracing at locations of doors, louvers and openings.

### 2.5 BUILDING TRIM

- A. General: Preformed 26 gauge galvalume steel with factory baked on paint flashing shall be provided at corners, end wall rakes, eaves, and openings to assure a neat, weather tight structure. All trim shall comply with windloads in structural drawing for wind pressures for components of cladding. Provide approved engineered testing certificates which show compliance with FBC.
- B. Eave Flashing: The junction of the roof panels and side wall panels shall be adequately flashed with preformed 26 gauge galvalume steel with factory baked on paint. Eave flashing shall be as shown on Architectural drawings and as per manufacturer's recommendations.
- C. Eave Gutter: Eave gutter shall be a suspended box section supported at 3'-0" on center maximum and formed to match the configuration shown on Architectural drawings. Eave gutters shall have a minimum cross sectioned area of 18 square inches. Pop rivets and sealant shall be used to secure and seal the gutter end laps.
- D. Eave Gutter Downspouts: Downspouts shall be 28 gauge, galvalume, painted, 4" x 5" rectangular sections. Spacing of the downspouts as shown on Architectural drawings. Eave gutter outlets shall be provided to connect the downspouts to the eave gutter. Field connected downspout elbows shall be provided to divert water away from the building.
- E. Corner Flashing: The junction of side wall panels and end wall panels shall be adequately flashed to provide weather tightness and good appearance. The flashing shall be designed to compliment the wall panel used and shall match the wall panel color.

- F. Accessory Flashing: Accessories which penetrate the wall or roof panels shall be adequately flashed and sealed as necessary for weather tightness and neat appearance.

### 2.5.1 Personnel Doors

- A. Materials: Fabricate personnel doors and frames from commercial quality, cold-rolled carbon steel sheet or commercial quality hot-rolled, pickled and oiled carbon steel sheet.
  - 1. Zinc-coated Steel Sheets: Comply with ASTM A 526; with G60 coating complying with ASTM A 525, mill phosphatized.
- B. Anchors and Accessories: provide manufacturer's standard units for items built into exterior walls, use galvanized units complying with ASTM A 153.
- C. Doors: Provide doors of types and styles indicated. Comply with SDI-100 for material quality, metal gages, and construction details.
  - 1. Provide sightproof lovers for interior doors with indicated, constructed of 24-gage (0.0239-inch) steel V-shaped or Y-shaped blades, set into 20-gage (0.0359-inch) steel frame.
- D. Frames: Provide frames of the types and sizes indicated. Comply with SDI-100 for material quality, metal gages, and construction details.
  - 1. Provide standard hollow metal frames for doors, transoms, sidelights, borrowed lights, and other openings as indicated.
  - 2. Prepare frames to receive 3 silencers on strike jambs of single door frames and 2 silencers on heads of frames for pairs of doors.
- E. Fabrication: Fabricate units to be rigid, neat in appearance, and free from defects, warp, or buckle. Provide continuous welds on exposed joints; grind, dress, and make welds smooth, flush, and invisible.
- F. Hardware: See Door Hardware Section 08700.
- G. Shop-paint exposed surfaces, including galvanized surfaces, using manufacturer's standard baked-on rust-inhibitive primer.

### 2.6 SHOP FABRICATION

- A. Scope: All fabricated members shall be sheared, formed, punched, welded, painted in the plant of the manufacturer. All holes and clips required to facilitate the attachment of secondary framing shall be provided by the metal building manufacturer. See Architectural, structural, Mechanical drawings for

other items to be attached to the structure.

- B. Welding: All shop welding shall be in accordance with the American Welding Society's Structural Welding Code (AWS D1.1) current edition except for Sections 3.5 and 8.13. All welding shall be done by welders certified in accordance with AWS Code. Flanges and webs of "I" sections shall be joined by a continuous automatic submerged arc welding process or a semi-automatic GMAW process. The web shall be joined to the flanges by a minimum of 50% web penetration.
- C. Structural Primer: All fabricated members other than galvalume, galvanized, pre-painted panel and flashing material shall receive a factory applied coat of rust inhibiting green primer. The primer shall be formulated to equal or exceed the performance of Federal Specification TT-P-636D.
- D. Identification: All fabricated or purchased items shall have an identifying mark which corresponds to the mark shown on the erection drawings. The mark shall be stamped, stenciled, or printed on or attached to the items.

## 2.7 CLOSURE AND SEALANTS

- A. Closure Strips: The corrugations of the roof and wall panels shall be filled with preformed closed cell non-shrinking, laminated polyethylene closures along the eave, ridge and rake for weather tightness.
- B. Metal Closures: The corrugations and pan area of the standing seam roof panel shall be filled with formed metal closures. The closures shall be formed from 20 gauge steel to the shape of the configuration. The closure exterior finish shall be AZ 55 Aluminum-zinc alloy coated.
- C. Sealer: Standing Seam, side laps shall have factory applied mastic, Sika SikaCaulk 501 or approved equal. Its composition shall be 91% solids by weight. Service temperature range shall be -60 degrees F to +250 degrees F. The material shall or surpass the requirements of Federal Specification TT-C-1796A, Type I, Class A.
- D. Sealer: Standing Seam, ridges and eave closures shall be sealed with tape mastic, Sika SikaTape 65 or approved equal. The Material shall be non-staining, non-corrosive, non-toxic, and non-volatile. Composition shall be 100% solid ethylene propylene copolymer tape. Service Temperature shall be from -60 degrees F to + 212 degrees F. The Material shall meet or surpass the requirements of Federal Specifications TT-C-1796a Type II, Class B.
- E. PIPE FLASHING: Manufactured one piece construction from EPDM membrane and shall have an aluminum base that can be field conformed to any panel configuration.

- F. LOUVERS: Coordinate openings with Architectural Drawings and Louver Section 10200 of specifications.

## PART-3 EXECUTION

### 3.1 INSTALLATION

- A. The erection of the structural members, and the installation of the standing seam roofing, insulation, wall panels and miscellaneous accessories shall be performed in accordance with the drawings, project manual, and in accordance to the manufacturers written and drawn instructions. The erection shall be performed by a manufacturer approved erector. All erection practices shall conform to Section 6, Common Industry Practices found in the "Low Rise Building Systems Manual", MBMA. Do not make any field modifications to structural members without the written acceptance of the Architect/Engineer.
- B. Clean surfaces as per manufacturers recommendations.

### 3.2 ERECTION

- A. Framing: Erect framing true to line, level, plumb, rigid, and secure. Level base plates to a true even plane with full bearing to supporting structures, set with double-nutted anchor bolts. Use a non-shrinking grout to obtain uniform bearing and to maintain a level base line elevation. Moist cure grout for not less than 7 days after placement.
- B. Purlins and Girts: Provide rake or gable purlins with tight-fitting closure channels and fascias. Locate and space wall girts to suit door and window arrangements and heights. Secure purlins and girts to structural framing and hold rigidly to a straight line by sag rods.
- C. Bracing: Provide diagonal rod or angle bracing in roof and side walls as indicated.
  - 1. Movement-resisting frames may be used in lieu of side wall rod bracing, to suit manufacturer's standards.
  - 2. Where diaphragm strength of roof or wall covering is adequate to resist wind forces, rod or angle bracing will not be required.
- D. Framed Openings: Provide shapes of proper design and size to reinforce openings and to carry loads and vibrations imposed, including equipment furnished under mechanical and electrical work. Securely attach to building structural frame.

### 3.3 ROOFING AND SIDING

- A. General: Arrange and nest side lap joints so prevailing winds blow over, not into, lapped joints. Lap ribbed or fluted sheets one full rib corrugation. Apply panels and associated items for neat and weathertight enclosure. Avoid "panel creep" or application not true to line. Protect factory finishes from damage.
1. Field cutting of exterior panels by torch is not permitted.
  2. Provide weather seal under ridge cap. Flash and seal roof panels at eave and rake with rubber, neoprene, or other closures to exclude weather.
- B. Standing-Seam Roof Panel System: Fasten roof panels to purlins with concealed clip in accordance with the manufacturer's instructions.
1. Install clips at each support with self-drilling fasteners.
  2. At end laps of panels, install tape caulk between panels.
  3. Install factory-caulked cleats at standing-seam points. Machine-seam cleats to the panels to provide a weathertight joint.
- C. Wall Sheets: Apply elastomeric sealant continuously between metal base channel (sill angle) and concrete and elsewhere as necessary for waterproofing. Handle and apply sealant and backup in accordance with the sealant manufacturer's recommendations.
1. Align bottom of wall panels and fasten panels with blind rivets, bolts, or self-tapping screws. Fasten flashings and trim around openings and similar elements with self-tapping screws. Fasten window and door frames with machine screws or bolts. When building height requires two rows of panels at gable ends, align lap of gable panels over wall panels at eave height.
  2. Install screw fasteners with power tools having controlled torque adjusted to compress neoprene washer tightly without damage to washer, screw threads, or panels. Install screws in predrilled holes.
  3. Provide weatherproof escutcheons for pipe and conduit penetrating exterior walls.
- D. Sheet Metal Accessories: Install gutters, downspouts, ventilators, louvers, and other sheet metal accessories in accordance with manufacturer's recommendations for positive anchorage to building and weathertight mounting. Adjust operating mechanism for precise operation.
- E. Hollow Metal Doors and Frames: Install doors and frames straight, plumb, and level. Securely anchor frames to building structure. Set units with 1/8-inch maximum clearance between door and frame at jambs and head and 3/4-inch maximum between door and floor. Adjust hardware for proper operation.
- F. Overhead Coiling Doors: Set doors and operating equipment complete with

necessary hardware, jamb and head mold stops, anchors, inserts, hangers, and equipment supports in accordance with manufacturer's instructions. Adjust moving hardware for proper operation.

- G. Thermal Insulation: Install insulation concurrently with installation of roof panels in accordance with manufacturer's directions. Install blankets straight and true in one-piece lengths with both sets of tabs sealed to provide a complete vapor barrier. Locate insulation on underside of roof sheets, extending across the top flange of purlin members and held taut and snug to roofing panels with retainer clips. Install retainer strips at each longitudinal joint, straight and taut, nesting with roof rib to hold insulation in place.

END SECTION 13120

## **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, Model #208V, 3 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.

- 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 15010 - MECHANICAL GENERAL PROVISIONS**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Each Section within Division 15, Mechanical, shall conform to the requirements of the General Conditions of the Contract, including Supplementary General Conditions, Special Conditions, and all requirements of Division 1.
- C. Each Section within Division 15, Mechanical, shall conform to the additional requirements of this Section, Mechanical General Provisions.

#### **1.2 ARTICLES INCLUDED**

- A. Definitions.
- B. Permits, Fees and Notices.
- C. Applicable Publications.
- D. Code Compliance.
- E. Scope of Work.
- F. Record Drawings.
- G. Intent of Drawings and Specifications.
- H. Quality Assurance
- I. Submittals.
- J. Product Requirements, Equals and Substitutions.
- K. Manufacturers Instructions.
- L. Transportation and Handling.
- M. Storage and Protection.
- N. Cutting, Patching and Demolition.
- O. Cleaning Up/Removal of Debris.
- P. Starting of Mechanical Systems.
- Q. Operating and Maintenance Manuals.
- R. Training of Owners Operators.
- S. Guarantee of Work.

T. System Testing.

1.3 ARTICLES

A. Definitions:

1. The term "As indicated" means as shown on drawings by notes, graphics or schedules, or written into other portions of contract documents. Terms such as "shown", "noted", "scheduled" and "specified" have same meaning as "indicated", and are used to assist the reader in locating particular information.
2. The term "Provide", means furnish and install as part of the work covered in Division 15.
3. The term "Furnish" means furnish only, for installation, as part of this contract, by other Divisions.
4. The term "Install only" means to install under the work of Division 15 equipment furnished by other Divisions, or by the Owner.
5. The term "Owner's Representative" when referenced herein shall be the Architect or the Engineer acting as his designated representative unless otherwise noted.
6. The term "design" as it pertains to the work of this division shall describe the basic intent, component sizing, component relationships and overall architecture of the HVAC, plumbing and fire protection system. The design is generally schematic in nature and will require specific detailing after the accepted products are determined.
7. The term "detail" as it pertains to the work of this division shall describe the work required by the contractor to assure a fully coordinated installation of the material and equipment supplied. When requested, the contractor shall produce detailed shop drawings or sketches indicating the actual placement of the equipment or material supplied; also including how the equipment or material interfaces with work of other sections or divisions within the contract documents.
8. The term "workman-like manner" as it pertains to the work of this division shall describe a neat well organized high quality installation system (duct, pipe, control wire or tube, conduit, etc.). Routing shall be well thought out providing adequate service clearance and maximum use of space. Equipment placement shall exhibit proper clearances for service. All lines (duct, pipe, control wire or tube, conduit, etc.) shall be run straight and true, parallel or perpendicular to building structure neatly supported.
9. For additional definitions refer to the General Conditions.

B. Permits, Fees and Notices: Comply with the General Conditions.

C. Applicable Publications:

1. Publications listed in each Section form a part of that Section to the extent referenced.
2. When a standard is specified by reference, comply with requirements of that standard, except when requirements are modified by the Contract Documents, or applicable codes establish stricter standards.
3. The Publication or Standard is the publication in effect as of the bid date, except when a specific date is listed.

D. Code Compliance:

1. 2006 Life Safety Code - NFPA 101
2. 2010 The Florida Building Code
3. 2010 The Florida Accessibility Code for Building Construction
4. 2008 National Electric Code (NEC)

5. 2010 The Florida Building Code – Mechanical
  6. 2010 The Florida Building Code - Plumbing
  7. 2010 Florida Fire Prevention Code (FFPC)
  8. 2009 NFPA Standards
- E. Scope of Work: The work to be performed under this Division consists of the satisfactory completion of all PLUMBING, HEATING, VENTILATING, AIR CONDITIONING, SMOKE CONTROL AND FIRE PROTECTION as indicated in the Contract Documents.
- F. Record Drawings: Comply with the General Conditions.
- G. Intent of Drawings and Specifications:
1. The intent of the drawings and specifications is to establish minimum acceptable quality standards for materials, equipment and workmanship, and to provide operable mechanical systems complete in every respect.
- E. Existing conditions, dimensions, etcetera, depicted on the drawings are taken from the "as-built" drawings of the original construction supplemented by field observation. The contractor is cautioned to field verify all existing conditions, dimensions, etcetera, notifying the Owner's Representative of any discrepancies Record Drawings: Comply with the General Conditions.
- F. Intent of Drawings and Specifications:
2. The intent of the drawings and specifications is to establish minimum acceptable quality standards for materials, equipment and workmanship, and to provide operable mechanical systems complete in every respect.
  3. Existing conditions, dimensions, etcetera, depicted on the drawings are taken from the "as-built" drawings of the original construction supplemented by field observation. The contractor is cautioned to field verify all existing conditions, dimensions, etcetera, notifying the Owner's Representative of any discrepancies other than those minor in nature, for direction, prior to ordering or fabricating equipment or materials. Anything mentioned in the specifications and not shown on the drawings, or shown on the drawings and not mentioned in the specifications, shall be of like effect as if shown or mentioned in both. In case of difference between drawing and specifications, the more stringent shall govern, unless the discrepancy conflicts with applicable codes, wherein the code shall govern.
  4. The drawings are diagrammatic, intending to show general arrangement, capacity and location of system components, and are not intended to be rigid in detail. Final placement of equipment, other system components, and coordination of all related trades shall be the contractor's responsibility.
  5. Due to the small scale of the drawings, and to unforeseen job conditions, all required offsets and fittings may not be shown but shall be provided at no additional change in contract cost.
  6. In the event of a conflict, the Owner's Representative will render an interpretation in accordance with the General Conditions.
- G. Quality Assurance:
1. All equipment furnished under this Division shall be listed and labeled by U.L., ETL or a nationally recognized testing laboratory (NRTL).
  2. Material furnished under this Division shall be standard catalogued products of recognized manufacturers regularly engaged in the production of such material and shall be the latest design.

3. Materials shall be the best of their respective kinds. Materials shall be new except where the specifications permit reuse of certain existing materials.
  4. Work provided for in these specifications shall be constructed and finished in every part in a workmanlike manner.
  5. All items necessary for the completion of the work and the successful operation of a product shall be provided even though not fully specified or indicated on the drawings.
  6. All work to be performed by qualified and experienced personnel specifically trained in their respective field.
  7. All work of this division shall be carefully interfaced with the work of other divisions to assure a complete, functioning system or systems.
- H. Submittals: Comply with the General Conditions.
- I. Product Requirements, Equals and Substitutions: Comply with the General Conditions.
- J. Manufacturer's Instructions:
1. Installation of work shall comply with manufacturer's printed instructions.
  2. Should job conditions or specified requirements conflict with manufacturer's instructions, consult with Owner's Representative for clarification. Do not proceed with work without clear instructions.
- K. Transportation and Handling: Comply with General Conditions.
- L. Storage and Protection:
1. Store products in accord with manufacturer's instructions, with seals and labels intact and legible.
  2. Store products to prevent damage by the elements. Space temperature shall be controlled as required to prevent condensation and metal corrosion or damage to electrical or electronic parts are the result of condensation.
  3. Arrange storage in a manner to provide easy access for inspection. Make periodic inspections of stored products to assure that products are maintained under specified conditions, and free from damage or deterioration.
  4. Provide protection as necessary to prevent damage after installation.
  5. Products which suffer damage due to improper storage shall not be installed and if found in place, shall be removed and replaced at the contractors expense.
- M. Cutting and Patching: Comply with the General Conditions.
- N. Cleaning Up/Removal of Debris:
1. Comply with the General Conditions.
  2. Maintain a clean work area. Construction debris shall be immediately removed from all newly erected work.
- O. Starting of Mechanical Systems:
1. Provide material and labor to perform start-up of each respective item of equipment and system prior to beginning of test, adjust and balance procedures.
  2. Provide labor to assist the Owner's Representative in acceptance review.
  3. Provide point by point system check-out. Submit results in tabulated form by system. Include this data as part of Operation and Maintenance Manuals.
  4. Provide information and assistance and cooperate with test, adjust and balance services.

5. Comply strictly with manufacturer's recommended procedures in starting up mechanical systems.
  6. Provide such periodic continuing adjustment services as necessary to ensure proper functioning of mechanical systems until acceptance and up to 1 full year after date of Owner acceptance.
- Q. Operating and Maintenance Manuals: Comply with the General Conditions.
- R. Training of Owners Operators:
1. The owners shall be given comprehensive training in the understanding of the systems and the operation and maintenance of each major piece of equipment.
  2. The contractor shall be responsible for scheduling the training which shall start with classroom sessions followed by hands on training on each piece of equipment. Hands on training shall include start-up, operation in all modes possible, shut-down and any emergency procedures.
  3. Training shall be conducted in a minimum of three sectors. The first, or orientation portion, shall be scheduled prior to system start-up. The second, or equipment portion, shall be scheduled as soon as possible after start-up of the equipment and the third portion, or the TAB and commissioning portion, shall be conducted after completion of this work.
  4. Classroom sessions shall include the use of overhead projections, slides, video and audio taped material as might be appropriate.
  5. The training sessions shall follow the outline in the Table of Contents of the operation and maintenance manual.
  6. The manufacturer's representative shall provide the instructions on each major piece of equipment. These sessions shall use the printed installation, operation and maintenance instruction material included in the O&M manuals and shall emphasize safe and proper operating requirements and preventative maintenance.
  7. The contractor shall attend all sessions and shall add to each session any special information relating to the details of installation of the equipment as it might impact the operation and maintenance.
  8. The building controls system contractor shall attend all sessions and be prepared to conduct the controls portion of the training as it relates to each equipment section.
  9. The building controls system contractor shall conduct the training session on the controls system hardware and software.
  10. The piping, insulation and sheet metal sub-contractors shall conduct sessions on their respective trades with emphasis on any peculiarities of the systems, pressure limitations and maintenance requirements.
  11. The TAB sub-contractor shall conduct a training session reviewing the procedures and methods used in the TAB process, shall review the TAB data and shall demonstrate use of test equipment which may have been turned over to the owner and shall point out the locations of all pitot traverse locations for the owner's future use.
- S. Guarantee of Work:
1. Comply with the General Conditions.
  2. Where applicable, furnish manufacturer's written warranty for materials and equipment.
  3. Insert warranties in appropriate locations in operating and maintenance manuals.
  4. Materials and equipment having seasonal operation limitations, shall be guaranteed for a minimum of one year from date of seasonally appropriate test, and acceptance in writing by the Owner, unless specific Division 15

specifications specify a longer period.

T. System Testing:

1. Provide all necessary labor, materials and equipment to successfully complete all system testing necessary for building occupancy and owner acceptance.
2. Provide all necessary labor, materials and equipment to assist contractors of other division to complete system testing necessary for building occupancy and owner acceptance, wherever an inter-relationship between Division 15 and the work of other divisions exists.
3. Tests shall be repeated as necessary until all occupancy and operation permits are granted and the owner accepts the project.

PART 2 – PRODUCTS (Not Applicable)

PART 3 – EXECUTION (Not Applicable)

END OF SECTION 15010



SECTION 15050 - BASIC MATERIALS AND METHODS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Provisions of Section 15010, Mechanical General Provisions, shall be made an integral part of this section.
- C. Provisions of Division 7 for Waterproofing and Flashing and Fire and Smoke Stopping requirements.

1.2 WORK INCLUDED

- A. Access doors.
- B. Waterproofing and flashing.
- C. Piping and equipment identification.
- D. Fire and smoke stopping.
- E. Electrical requirements.
- F. Painting.
- G. Concrete work.
- H. Fabricated steel supports.
- I. Excavation, trenching and backfilling.
- J. Placing of equipment.

1.3 RELATED WORK

- A. DIVISION 9 - FINISHES (Access Doors - Painting).
- B. DIVISION 7 - THERMAL AND MOISTURE PROTECTION (Waterproofing and Flashing) and (Fire and Smoke Stopping).
- C. DIVISION 3 - CONCRETE.
- D. DIVISION 2 - SITEWORK (Excavation).

1.4 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this Section to the extent referenced.
  - 1. American Institute of Steel Construction (AISC) Publications
  - 2. American National Standards Institute (ANSI) Standards
  - 3. American Society for Testing and Materials (ASTM) Publications
  - 4. American Welding Society (AWS) Publications

5. Underwriters Laboratories, Inc. (UL) Standards

1.5 SUBMITTALS

- A. Submit drawings of fabricated steel supports where proposed supports are not in accordance with details on drawings, or where drawings do not detail supports. Submittal for acceptance is required.
- B. Submittal for other than fabricated steel supports is not required. Product data for the following shall be included in the operation and maintenance manuals. Submittal for acceptance is not required.
  - 1. Access doors.
  - 2. Waterproofing and flashing material.
  - 3. Piping and equipment identification.
  - 4. Fire and smoke stopping material.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Access Doors:
  - 1. Acudor
  - 2. Elmodor Manufacturing, Co.
  - 3. Karp Metal Associates, Inc.
  - 4. Larsen's Manufacturing Co.
  - 5. Milcor
- B. Waterproofing and Flashing:
  - 1. Stoneman Engineering and Manufacturing Co.
  - 2. S.B.C. Industries.
  - 3. Other suppliers acceptable.
- C. Piping and Equipment Identification:
  - 1. Communications Technology Corp.
  - 2. Craftmark Identification Systems, Inc.
  - 3. EMED Co., Inc.
  - 4. Florida Marking Products, Inc.
  - 5. Marking Services, Inc.
  - 6. Seton Name Plate Corp.
  - 7. W.H. Brady Co., Signmark Division
- D. Fire and Smoke Stopping Material:
  - 1. General Electric Company.
  - 2. Hilti, Inc.
  - 3. International Protective Coatings Corp. (IPC) Division of Grace Construction Prod.
  - 4. Johns Manville
  - 5. Rectorseal
  - 6. Tremco, Inc. Sealant/Weatherproofing Division
  - 7. 3M Fire Protection Products.

2.2 FABRICATION

- A. Access doors:
1. Access doors: UL labeled where installed in fire rated walls, partitions, and ceilings. Door rating shall be not less than wall, partition, or ceiling rating.
  2. Frames: 16 gauge steel, flush trim, with corners welded and ground smooth, masonry anchor strap for masonry walls, bolt holes for mounting in framed openings.
  3. Non-fire rated doors: 13 gauge steel, concealed continuous piano hinge with dust flap, flush screwdriver operated lock with stainless steel cam and studs.
  4. Fire rated doors: 20 gauge steel welded pan type, concealed continuous piano hinge with stainless steel pins, key-operated latch bolt, interior latch release, automatic door closer, automatic door latch when door closes. The door panel shall contain 2- inch thick insulation in sandwich type construction.
  5. Finish of doors and frames: Prime coat of rust inhibitive baked enamel, except as specified otherwise.
  6. Finish of doors and frames in wet areas, and in areas with surfaces subject to wet cleaning: No. 4 satin stainless steel.
- B. Waterproofing and Flashing: All work is provided under Division 7 - THERMAL AND MOISTURE PROTECTION.
- C. Piping and Equipment Identification:
1. Pipe markers: Sub-surface printed plastic, with protective undercoating. Markers shall be permanently curled for snap-on installation for pipe sizes (including insulation) up to 6" diameter. For external diameters above 8". Marker shall be secured using cable ties for indoor use and stainless steel banding or ultraviolet resistant plastic for exterior use. Markers for outdoor installation shall be overlaminated with Tedlar™ on polyester ultraviolet to avoid damage and fading. Markers shall identify the pipe contents and direction of flow through 360 degree visibility range. Marker size, letter size, letter color, wording and background color shall be in accord with ANSI A13.1 – Scheme for the Identification of Piping Systems. Based on Marking Services Inc. Model MS-970 Coiled Plastic Markers for indoor use and Model MS-995 Maxilar Marker for exterior use or approved equal.
  2. Valve tags: Contractors Option:
    - a. Indoor:
      - 1) 19 gauge brass, 1-1/2 inch round, with 1/4 inch high black pipe service letter abbreviation above 1/2 inch high black valve number. Pipe service letter abbreviation shall be in accord with legend on drawings. Valve tag attachment shall be 4 ply 0.018 copper wire meter seal or #6 solid brass bead chain with locking link. Based on Marking Services Inc or approved equal.
      - 2) 1/16 inch thick plastic, 1-1/2" round, with ¼ inch high black pipe service abbreviation above 1/2 inch high black valve number. Pipe service letter abbreviation shall be in accord with legend on drawings. Color of valve tag shall match pipe marker color. Valve tag attachment shall be 4 ply 0.018 copper wire meter seal or #6 solid brass bead chain with locking link. Based on Marking Services Inc or approved equal.
    - b. Outdoor Service:
      - 1) 19 gauge brass, 1-1/2 inch round, with 1/4 inch high black pipe service letter abbreviation above 1/2 inch high black valve number.

Pipe service letter abbreviation shall be in accord with legend on drawings. Valve tag attachment shall be 4 ply 0.018 copper wire meter seal or #6 solid brass bead chain with locking link. Based on Marking Services Inc or approved equal.

- 2) 19 gauge Type 304 stainless steel, 1-1/2" round, with 1/4 inch high pipe service abbreviation above 1/2 inch high black valve number. Pipe service letter abbreviation shall be in accord with legend on drawings. Color of valve tag shall match pipe marker color. Valve tag attachment shall be 4 ply 0.018 stainless wire meter seal or #6 Type 304 stainless steel bead chain with locking link. Based on Marking Services, Inc or approved equal.

3. Equipment nameplates:

- a. Indoor: Shall be 1/16 inch thick plastic with black satin surface and white core. Lettering shall be engraved through the surface color to expose the core color. Plate size shall be a minimum of 2-1/2 inch by 4 inch, with 3/4 inch high lettering for equipment and 3/4 inch by 2-1/2 inch, with 3/16 inch high lettering for ceiling grid labeling. Equipment identifying name and number shall be in accord with schedules on the Contract Documents. Plate manufacturer shall furnish pre-drilled hole locations for pop riveting. Where pop riveting is not suitable, a suitable adhesive for permanently attaching plate to equipment shall be provided.
- b. Outdoor: Shall be 125 Mil rigid plastic constructed of printed legend sealed between two layers of chemically-resistant plastic to resist ultraviolet damage. Plate size shall be a minimum of 2-1/2 inch by 4 inch, with 3/4 inch high lettering for equipment. Equipment identifying name and number shall be in accord with schedules on the Contract Documents. Plate manufacturer shall furnish pre-drilled hole locations for pop riveting. Where pop riveting is not suitable, a suitable adhesive for permanently attaching plate to equipment shall be provided.
- c. Based on Marking Services Inc. Model MS-215 Max-Tex or approved equal.

D. Fire and Smoke Stopping: Refer to Division 7 for extensive requirements. Fire and smoke stopping material: A one-part silicone elastomer, or a one-part intumescent elastomer caulk or putty, UL classified and FM approved with flame spread of 0 and smoke development not to exceed 50 in accord with ASTM E84. Material shall be suitable for penetration seals through fire-rated floors and walls when tested in accord with ASTM E814 under positive pressure. Material shall not melt or soften at high temperatures, shall be suitable for direct outdoor and ultraviolet exposures, shall cure to give a tight compression fit, and shall not produce toxic fumes. Material, when heated, shall expand to fill and hold penetration closed where burn out of cable insulation or ATC tubing occurs.

E. Electrical Requirements: Product description not applicable to this Section.

F. Painting: Product specified in Division 9 - FINISHES.

G. Concrete Work:

1. If applicable, concrete is provided under DIVISION 3 - CONCRETE.
2. This contractor to provide detailed dimension drawings, including anchor bolt locations where required for all bases and pads required for equipment furnished under this Division.
3. Concrete for equipment bases and pads shall be 3000 p.s.i. design mix prepared in accord with ASTM C94. Cement shall be in accord with ASTM C150. Aggregate shall be fine sand in accord with ASTM C33. Water shall be clean, fresh, drinkable.

- H. Fabricated Steel Supports:
  - 1. Steel angles, channels, and plate shall be in accordance with ASTM A36.
  - 2. Steel members, including fasteners, exposed to weather shall be galvanized.
- I. Excavation, Trenching, and Backfilling: Product description not applicable.
- J. Placing of Equipment: Product description not applicable.

### PART 3 - EXECUTION

#### 3.1 GENERAL

- A. Installation of materials and equipment shall be in accord with the manufacturer's written instructions, except as specified.

#### 3.2 INSTALLATION

- A. Access Doors:
  - 1. Furnish access doors for installation under Division 9 - FINISHES.
  - 2. Deliver access doors to the appropriate trade well in advance of the time they are needed so as to avoid unnecessary delay of the work.
  - 3. Access doors shall be sized as indicated on drawings. If no size is given, provide access door of size suitable for servicing equipment or valve. Unless otherwise noted, the minimum size for a access door shall be 12" x 12".
  - 4. Access doors shall be provided where indicated and if not indicated, where required.
  - 5. Access doors shall be installed so as to allow full door swing.
  - 6. Where full swing and access is not possible, removable doors shall be provided.
  - 7. Access doors not required in lay-in-tile ceilings.
- B. Waterproofing and Flashing: All penetrations of roof to be in accordance with requirements of Division 7 - THERMAL AND MOISTURE PROTECTION.
- C. Piping and Equipment Identification:
  - 1. Install pipe markers adjacent to each valve and fitting, at each branch connection, on each side of wall, floor, and ceiling penetrations, where entering and leaving underground areas, and at minimum 40 foot spacing on horizontal and vertical pipe runs. Markers shall be arranged for easy reading at eye level.
  - 2. Provide valve tags on all valves exposed or concealed unless otherwise noted.
  - 3. Attach valve tag to stem of each valve to be tagged. Valve numbers shall follow in sequence the Owner's existing valve numbers, where applicable.
  - 4. Provide a marker for each valve and equipment to be tagged, located above lift-out tile ceilings. The marker shall be 1/16 inch thick plastic with a satin surface and white core. Color of the marker shall match color of piping identification system. Lettering shall be engraved through the surface color to expose the core color. Plate size shall be 3/4 inch by 2-1/2 inch, with 3/16 inch high lettering for ceiling grid labeling. Plate manufacturer shall furnish suitable adhesive for permanently attaching plate to ceiling grid.
  - 5. Provide air and water flow diagrams installed in waterproof, laminated frames on the wall in each Mechanical Room. Air flow diagrams shall show locations of dampers, sensors, and exhaust fans associated with the air handling unit. Water flow diagrams shall show shut-off valves and control valve locations.
  - 6. Permanently affix nameplate to each item of equipment using stainless steel pop

rivets. Where irregular surface impede direct attachment of plates, affix plate to sheet metal bracket and attach bracket to equipment with screws, bolts or suitable adhesive from nameplate manufacturer.

7. Refrigeration System - Additional Requirements:

a. Marking and Signage:

(1) Provide a permanent sign containing the following information:

- (a) Name and address of installer.
- (b) Kind of refrigerant.
- (c) Lbs. of refrigerant.
- (d) Field test pressure applied.

(2) Provide a permanent sign: Main electrical supply, i.e., main compr. disc.

(3) Provide metal tags with 0.5" letters:

- (a) Shut-off valves to each vessel, i.e., L.P. receiver shut-off.
- (b) Relief valve.

(4) If applicable, piping shall be marked as either:

- (a) Refrigerant - High Pressure - Liquid or Hot Gas.
- (b) Refrigerant - Low Pressure - Suction, Pumped Liquid Supply or Pumped Liquid Return.

D. Fire and Smoke Stopping:

1. Refer to Division 7 for further requirements.

2. Fire and smoke stopping shall be provided as required to meet all code requirements and at a minimum is required in the following locations:

a. Where exposed and concealed horizontal pipes, tubes, wires and ducts which are part of an active smoke control system that are not provided with fire dampers penetrate fire rated walls, shaft walls, and smoke barriers.

b. Where exposed and concealed vertical pipes, tubes, and wires ducts which are part of an active smoke control system that are not provided with fire dampers penetrate rated and non-rated floors.

3. Provide pipe or duct sleeve for all penetrations. Space between pipe or duct and sleeve shall not exceed the UL listing of the penetration.

4. Fill annular space between pipe and sleeve, or between duct and sleeve on non-dampened penetrations, with approved material.

5. Depth of material shall be in accord with laboratory tests for 1, 2, or 3 hour rated assemblies.

6. Damming material may be temporary non-fire approved, or permanent fire-approved. Where permanent fire-approved damming material is used depth of fire and smoke stopping material may be decreased in accord with manufacturer's recommendations. Temporary damming material shall be removed after installation of fire and smoke stopping material.

7. Seal all gaps or voids in cured foam with material to match the fire and smoke stopping material.

8. Trim excess cured foam from around all openings and leave smooth, flush surface.

E. Electrical Requirements:

1. Electrical apparatus, devices, controls, etc., required but not specified in detail in this Division shall conform to Division 16 - ELECTRICAL.
2. Except as otherwise detailed or specified, all power wiring required to operate electrical devices and equipment furnished in this Division will be provided under Division 16 - ELECTRICAL.
3. Control and interlock wiring required for all electrical devices and equipment furnished in this Division is specified under Section 15058 - CONTROL WIRING.
4. Motor driven equipment provided under this Division shall be provided with motors as specified in Section 15055 - MOTORS.
5. Refer to Division 16 for Motor Starter requirements.

F. Painting:

1. All equipment shall be furnished with a factory- applied galvanized, prime paint, or finish paint finish. Touch-up damaged surfaces of equipment immediately.
2. Paint for galvanized surfaces shall be in accordance with ASTM A780 using zinc rich compound.
3. Paint wooden mounting backboards with two coats of gray enamel prior to making attachments to the board.
4. For quality control refer to DIVISION 9 - FINISHES.
5. Remove all dirt, rust, scale, grease, pipe dope, solder flux, and welding slag from all surfaces to be painted.
6. Paint immediately, under this Division, all damaged galvanized surfaces. Paint galvanized metal surfaces behind grilles with two coats of flat black paint.
7. Apply rust inhibitive primer to ferrous surfaces of shop fabricated steel supports.
8. Paint immediately under this division all field and shop welded joints in piping or equipment supports with 2 coats of grey metal primer.

G. Concrete Work:

1. Concrete pads and curbs for supports of equipment shall be a minimum of 4" high with chamfered edges and sized for approved equipment. Furnish drawings to Division 3 Contractor.
2. Surfaces of concrete shall be troweled smooth. When forms are removed, fill voids with cement and rub smooth with rubbing stone.
3. Do not pour concrete when ambient temperature is less than 40°F, and falling.

H. Fabricated Steel Supports:

1. Because of the small scale of the drawings, details of equipment support are not always shown. It shall be the responsibility of the contractor to provide supports as required for safe and adequate support.
2. Fabricated steel supports and ladders may be shop or field-fabricated, and shall be in accord with details on drawings.
3. When details are not indicated, the contractor shall submit proposed support detail for review. The contractor shall bear all cost in producing this detail in the bid. This includes but is not limited to structural engineering support.
4. Steel members shall be saw cut, with corners ground smooth, and shall be assembled with welded or bolted connections at Contractor's option. Connections shall be in accord with specified AISC Publications.

I. Excavation, Trenching, and Backfilling:

1. Refer to DIVISION 2 - SITEWORK.

J. Placing of Equipment:

1. Coordinate setting of equipment with the requirements of other trades so as to avoid conflicts and to insure compatibility. Equipment shall not block access for installation of other equipment.
2. Set base mounted equipment on permanent and finished supports. Temporary support, if any, shall be removed prior to making final pipe, duct, or electrical connections to equipment.
3. Adjust suspended equipment to final elevation prior to making pipe, duct or electrical connections.
4. Exercise caution during equipment placing operations to insure that structure is not overloaded.
5. Do not move heavy equipment across floor or roof of insufficient load bearing capacity to support such equipment. Provide bracing or shoring as required, or use crane to place equipment directly on permanent and finished support.
6. Secure all roof mounted equipment to the structure adequately to resist overturning, uplift and sliding forces for basic wind speeds indicated for this location in 2010 Figure 1609B of the Florida Building Code, Latest Edition.
7. Guards shall be provided where appliances, equipment, fans or other components that require service are located within 10 feet of a roof edge or open side of a walking surface and such edge or open side is located more than 30 inches above the floor, roof or grade below. The guard shall extend not less than 30 inches beyond each end of such appliance, equipment, fan or component and the top of the guard shall be located not less than 42 inches above the elevated surface adjacent to the guard. The guard shall be constructed so as to prevent the passage of a 21-inch-diameter sphere and shall comply with the loading requirements for guards specified in the Florida Building Code.

END OF SECTION 15050



SECTION 15051 - ADJUSTING, BALANCING AND SYSTEM TESTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 WORK INCLUDED

- A. Checking installation for conformity to design.
- B. Checking each piece of equipment for proper installation and operation.
- C. Balancing air distribution systems to provide design fluid quantities.
- D. Measuring and recording of fluid quantities.
- E. Electrical measurement.
- F. Verification of performance of all equipment and sequence of operation of automatic controls.
- G. Checking sound levels and vibration isolators for proper function and measurement and correction where a problem or question of acceptability exists.
- H. Recording and reporting results on sub-contractors standard report forms and on commissioning data sheets where these have been provided.

1.3 REFERENCES

- A. Air Diffusion Council (ADC) 1062R3 Equipment Test Code
- B. Associated Air Balance Council (AABC)  
National Standards for Field Measurements and Instrumentation, Total Balance System Balance, Air Distribution - Hydronic Systems, Volume 1.

1.4 SUBMITTALS

- A. Submit complete description of procedures, instrument calibration and qualifications of personnel actually doing testing and balancing on this project prior to beginning of any balancing.
- B. Submit schedules of test data readings in organized, schematic, tabulated format. Include schematic drawing showing location of all readings.
- C. Submit as-built drawings showing locations of all readings.

1.5 QUALITY ASSURANCE

- A. Adjusting, balancing and testing procedures and compilation of test data shall be performed by a Certified Test and Balance Engineer or by personnel trained and supervised by a Certified Test and Balance Engineer.
- B. Test and balance personnel shall be qualified to perform testing and balancing in

accordance with AABC or NEBB procedures.

#### 1.6 TOLERANCES

- A. Balance final airflow to within plus or minus 5 percent of specified quantities. Caution is urged on systems where diversity has been taken and the total flow exceeds the equipment capacity. In this case, the system must be sectioned as necessary to get proper terminal flow.

#### 1.7 GENERAL COMMENTS

- A. Air Balance: Readings from a pitot tube traverse will be given highest priority as to accuracy. Terminal flow shall be as taken from the terminal DDC flow readings. Outlet flow as established by flow hood will be used to pro-rate air flow. Pressure readings as well as voltage and ampere readings will be used for check purposes only. Temperature readings will be used as a check against performance.
- B. All readings shall be cross-checked for accuracy. These cross-checks shall be tabulated within the report.

#### PART 2 – PRODUCTS (Not applicable)

#### PART 3 - EXECUTION

##### 3.1 INTENT OF DRAWINGS AND SPECIFICATIONS

- A. Review drawings and specifications with regard to adjusting and balancing.
- B. Additional balancing devices which, in the opinion of the TAB sub-contractor, would aid in the adjusting and balancing of the systems shall be brought to the attention of the contractor prior to bid time so that the contractor may make allowances to cover the provision of these additional devices in the original bid.
- C. Minor modifications in system design which, in the opinion of the Contractor, would aid in the adjusting and balancing of the systems may be provided subject to approval of the Owner's Representative at no additional cost to the Owner. Design modifications shall not lessen the operating efficiency of the systems.

##### 3.2 AIR BALANCE

- A. Check system visually and audibly for leakage and proceed with balancing as outlined by AABC or NEBB.
- B. Balance for full flow shall be based on dirty friction loss across the filters. Artificially blank-off sections on a uniform pattern as required to simulate this condition.
- C. Constant Volume Systems:
  - 1. Adjust each fan to deliver the specified quantity of air at the specified temperatures to all areas of the building served by the air system. Where the installed drive cannot be adjusted to obtain the required flow, advise the contractor so that the necessary drive change can be made. Adjust speed, in direct proportion to actual vs. required cfm. Exercise caution because amps vary with the cube of speed.
  - 2. Determine air volume in ducts by use of pitot tube, and inclined manometer. Plug all holes in duct.

3. Determine air quantity through air grilles or diffusers by use of flow hood with direct readout meter calibrated in CFM. If use of flow hood is not possible, use velometer nozzle as recommended by air device manufacturer. Calculate air quantity based on air device area factors provided by the air device manufacturer.
4. Compare duct traverse to accumulated air flow at diffusers. If the two do not reconcile, examine system for leaks and, report to contractor so that he can repair and repeat.

### 3.3 CONTROLS ADJUSTMENT

- A. Check the automatic temperature controls to ascertain that the specified sequence of operation is occurring. Record thermostat set point and room conditions in each space.
- B. Compare temperature of space (taken with test instrument) to temperature read by thermostat or temperature sensor. Tabulate results.
- C. In cooperation with the controls contractor, set adjustments of automatically operated dampers to operate as specified, indicated, and / or noted.
- D. Check all controls for proper calibrations, and list all controls requiring adjustment by control installers.

### 3.4 CONTRACTOR'S RESPONSIBILITIES

- A. Final testing and balancing of the HVAC systems shall be performed as specified in this section. It is the responsibility of the Contractor to be completely familiar with all the provisions and responsibilities of the Balancer, and to provide such certification, cooperation, and support required.
- B. The Contractor shall repair all deficiencies noted by the Balancer in a timely manner. The Balancer will notify the contractor in writing, on a daily basis, of any deficiencies discovered and Contractor will notify the Balancer immediately, in writing, upon completion of the repairs. The cost for extra re-testing by the Balancer due to un-repaired items that were certified as repaired, will be the responsibility of the Contractor. The final testing and balancing report will contain no punch list items. All deficiencies will have been corrected prior to submission of the final report. Preliminary reports are not to be submitted to the Owner.
- C. The Contractor shall:
  1. Allow adequate time in the construction schedule to perform the Testing and Balancing work.
  2. Notify the Balancer upon commencement of work related to the HVAC system.
  3. Provide required shop drawings and equipment data.
  4. Provide test openings as required for testing and balancing HVAC systems.
  5. Provide updated job schedule and timely notice prior to scheduled events.
  6. Provide test openings and temporary end caps or otherwise seal off ends of ductwork to permit leakage testing prior to installation of diffusers, grilles, and similar devices.
  7. Make preliminary tests to establish adequacy, quality, safety, completed status, and satisfactory operation of HVAC systems and components. The systems shall be free of electrical grounds and short circuits.
  8. Perform duct leakage tests, in the presence of the Balancer, on all supply, return, outside air make-up, and exhaust air systems.

9. Within the intent of the contract documents, provide, at the request of the Balancer, all equipment, material, supplies, workmen, and supervisions necessary to provide a satisfactory, operating system.
  10. During the test and balance period, operate all HVAC equipment as necessary to permit systems to be tested and balanced as fully operating, functional systems.
  11. Work harmoniously with the Balancer, providing all courtesies normally extended to professional consultants.
  12. Perform all work necessary to make ceiling plenums air-tight and functional.
  13. Remove and replace ceilings as necessary to permit test and balance operations.
  14. Remove and replace equipment, lights, or other items which obstruct testing and balancing operations. Where equipment, lights, or other items will interfere with future adjustments of the HVAC system, such equipment, lights, or other items shall be relocated by the Contractor, as directed by the Architect.
  15. Provide completed start-up forms on each piece of equipment.
  16. Replace belts and drives as required for proper balancing. Drives shall be adjusted and aligned by the Contractor to prevent abnormal belt wear and vibration.
  17. Adjust fan speed as required not to exceed RFLA of motor.
  18. Open all manually adjustable dampers and test dampers for smooth, vibration-free operation.
  19. Verify that all controls are installed and operating in accordance with the sequence of operation.
  20. Before requesting final testing and balancing, submit signed statement that HVAC systems are installed, adjusted, fully lubricated, operating satisfactorily, and are ready for use.
- D. Duct Leakage Report: The Contractor shall make all the supply, return, outside air, and exhaust duct systems (limited to 1,500 cfm and greater) operationally air-tight, with no more than 2% leakage for duct systems rated at 2" w.c. pressure class, and 1% leakage for systems exceeding 2" w.c. pressure class. Leakage test to be performed by Contractor with all air device openings and fan connections sealed airtight. Test the systems prior to applying any insulation or concealing in soffits or chases. Use a portable fan capable of producing a static pressure equal or greater than the duct test pressure. This fan to have a flow measuring assembly consisting of a straight section of duct with an orifice plate, pressure taps, and a calibrated performance curve for determining leakage rates.
1. Test each section equal to the external static pressure indicated for that fan or air handler with the portable fan assembly. After the fan achieves that steady state design pressure, record the air flow quantity across the orifice and the percent of design air flow. If the test fails, the Contractor shall reseal and retest at no additional cost to the Owner.
  2. Repair all duct leaks that can be heard or felt, even if the system has passed the leakage test.
  3. Submit duct leakage reports to the Balancer and the Engineer for their review and approval.

### 3.5 TEST DATA SCHEDULES

- A. Submit typewritten schedules of test data readings.
- B. Schedules shall record the specified reading, the first reading taken and the final balanced reading for the following items.
- C. Where Commissioning Forms are provided, equipment data shall be recorded on these

forms for comparison with submitted design data.

- D. Witness and record the testing of the ductwork for leakage to insure proper sealing. The Balancer shall randomly select sections of the completed duct system for testing. The sections selected shall not exceed more than 20% of the measured linear footage of supply, return, exhaust or plenum duct length. All selected ductwork shall be leak tested in accordance with SMACNA. Maximum allowable leakage at any tested section shall not exceed 2% of the total air. If any of the selected duct sections exceed the specific leakage allowance, those sections shall be repaired by the Contractor and retested by the Balancer. If initial testing exceeds specification allowance, testing of all remaining ductwork shall be required at the Contractor's expense. All additional costs for duct leak repair and retesting shall be the responsibility of the Contractor.
- E. Advise Contractor in writing of all ductwork that shall be repaired to reduce air leakage. Retest to confirm minimum allowable leakage. The cost of retest of failed systems will be the responsibility of the Contractor.
- F. In the case of off season performance testing of air handling equipment and refrigeration equipment, include manufacturer's projected performance for comparison.
  - 1. Motors:
    - a. Designation.
    - b. Nameplate HP, voltage and full load amperes.
    - c. RPM.
    - d. Motor amperes and voltage under operating conditions.
    - e. For belt drive applications, motor amperes and voltage under no load condition.
  - 2. Fans:
    - a. Designation.
    - b. Nameplate data.
    - c. RPM.
    - d. Static pressure, inlet and discharge.
    - e. CFM from pitot tube traverse of discharge duct.
    - f. Final pitot tube traverse sheets showing all readings.
  - 3. Main and Sub-main Ducts:
    - a. Designation and location.
    - b. CFM from pitot tube traverse.
    - c. Final pitot tube traverse sheets showing all readings.
  - 4. Air Outlets and Inlets:
    - a. Room designation.
    - b. Type of outlet.
    - c. Design CFM.
    - d. Measured CFM.
    - e. Method of measurement.
    - f. All final measurement readings.
  - 5. Cabinet Unit Heaters (Required on 10% of Units, each Size Including Units with Flow Control Devices):

- a. Designation.
- b. Nameplate data.
- c. Static pressure entering and leaving air.
- d. Dry bulb and wet bulb temperatures, entering and leaving air.
- e. CFM (pitot tube traverse or velometer reading at grille including all final readings used to obtain cfm.
- f. Room dry bulb and wet bulb.
- g. Room thermostat setting.
- h. Fan speed setting.
- i. Motor amperes and voltage.

6. Air Cooled Condensing Units:

- a. Designation.
- b. Nameplate, Model No. & Serial No.
- c. Refrigeration type and operating charge.
- d. Suction pressure (PSIG).
- e. Discharge pressure (PSIG).
- f. Outdoor air inlet temperature (F).
- g. Condensing air outlet temperature (F).
- h. Air flow (CFM).
- i. Heat rejection calculation (tons).

7. Direct Expansion Cooling Coil:

- a. Designation.
- b. Nameplate data.
- c. Entering air DB (F).
- d. Entering air WB (F).
- e. Leaving air DB (F).
- f. Leaving air WB (F).
- g. Evaporative pressure (PSIG).
- h. Air flow (CFM).
- i. Load calculation (tons).

3.6 OPERATING TESTS

- A. Operate systems to demonstrate that systems have been properly adjusted and balanced, and to demonstrate that the systems' performance conforms with the intent of the specifications and drawings.
- B. The balancing contractor shall make available to the Owner's operating personnel a Certified Test and Balance Engineer for a minimum of 16 hours, two working days, not necessarily consecutive, with all necessary equipment to demonstrate that all systems operate as intended and that the balancing reports are accurate.
- C. This demonstration will occur after the balancing contractor has submitted his reports to confirm that all systems or portions of the systems that coincide with the building's occupancy schedule, are adjusted and balanced.
- D. Conduct tests with natural building heating and/or cooling loads for a minimum 4 hours duration.

END OF SECTION 15051

SECTION 15055 - MOTORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 WORK INCLUDED

- A. Motors for equipment furnished under Division 15.

1.3 STANDARDS

- A. NEMA Publications MG-1, MG-2, MG-13.

1.4 QUALITY ASSURANCE

- A. Motor efficiencies in accordance with IEE Standard 112 Method B as defined by NEMA MG1-1.23 a and b.

1.5 SUBMITTALS

- A. Submission for acceptance is required. All three phase motors are based on NEMA Premium™ efficiency motors as described below by the minimum allowable efficiency. As a result, all motor starting codes are based on Code letter F or greater as defined by NEC Article 430. In the event that a manufacturer provides a motor with a code letter less than F, the overcurrent protection of the motor shall be coordinated with the Division 16 Contractor to comply with NEC Article 430.
- B. Product data, along with installation operation and maintenance instructions, shall be included in the operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. A.O. Smith/Century E-Plus
- B. Baldor Electric Company, Premium Efficiency.
- C. Emerson Electric Company, U.S. Electrical Motors Div., Premium Efficiency Type 'DE' & 'RE'.
- D. The Louis Allis Company, High Efficiency.
- E. General Electric Company, Premium Efficiency Energy Saver®
- F. Reliance Electric Manufacturing Company, XE™ Premium Efficiency Motors.

2.2 FABRICATION

- A. 3/4 HP and Larger Horsepower Motors:
  - 1. NEMA Premium™ efficiency type having the following minimum efficiencies:

Minimum Nominal Full-Load Motor Efficiency (%)						
	Open Motors			Totally Enclosed		
Number of Poles	2-Pole	4-Pole	6-Pole	2-Pole	4-Pole	6-Pole
Speed (RPM)	3600 RPM	1800 RPM	1200 RPM	3600 RPM	1800 RPM	1200 RPM
HP						
0.75	---	85.5	---	---	85.5	---
1	82.5	85.5	82.5	77.0	85.5	82.5
1.5	84	86.5	86.5	84.0	86.5	87.5
2	85.5	86.5	87.5	85.5	86.5	88.5
3	85.5	89.5	88.5	86.5	89.5	89.5
5	86.5	89.5	89.5	88.5	89.5	89.5
7.5	88.5	91	90.2	89.5	91.7	91.0
10	89.5	91.7	91.7	90.2	91.7	91.0
15	90.2	93	91.7	91.0	92.4	91.7
20	91	93	92.4	91.0	93.0	91.7
25	91.7	93.6	93	91.7	93.6	93.0
30	91.7	94.1	93.6	91.7	93.6	93.0
40	92.4	94.1	94.1	92.4	94.1	94.1
50	93	94.7	94.1	93.0	94.5	94.1
60	93.6	95	94.5	93.6	95.0	94.5
75	93.6	95	94.5	93.6	95.4	94.5
100	93.6	95.4	95	94.1	95.4	95.0
125	94.1	95.4	95	95.0	95.4	95.0
150	94.1	95.8	95.4	95.0	95.8	95.8
200	95	95.8	95.4	95.4	96.2	95.8
250	95	95.8	95.4	95.4	96.2	95.8
300	95	95.8	95.4	95.4	96.2	95.8

2. Open drip proof, except motors located outdoors to be TEFC or as otherwise specified.
3. Continuous duty, 40°C ambient.
4. Regreasable ball bearing design.
5. Speed/Torque curves shall be NEMA Design B so that overload protection provided by standard motor starters will be adequate to prevent over-heating during stall or slightly prolonged motor acceleration.
6. Class B insulation, except motors for variable speed drive application to be specially built for Adjustable Frequency Drive (AFD) duty and include Class F insulation and be suitable for operation down to 10% on fan and pump applications.
7. Assembly to meet application.
8. 1.15 service factor.
9. Suitable for starter type as scheduled on drawings.
10. Slide bases as required.
11. 60 Hz. terminal box large enough to accommodate the required conduit and wiring.
12. 200, 208, 230 or 460 volt, 3 phase as scheduled.
13. Provide shaft grounding rings on all motors driven by a VFD. Typically to an



AEGIS – SGR model.

B. Fractional Horsepower Motors:

1. Permanent split capacitor.
2. 115 volt, 1 phase, 60 Hz.
3. Thermally protected.
4. Other features of motors supplied as an integral part of a factory assembly shall be acceptable as the manufacturers standard based on acceptance of the assembly as a whole.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Motors:

1. Install in accordance with requirements of the duty.
2. Lugs to be provided under this Division.
3. All motors shall have overload protection as required by NEC. Any motor without integral protection shall have a starter that provides overload protection furnished by Division 15.

END OF SECTION 15055

SECTION 15058 - CONTROL WIRING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Provisions of Section 15010 - Mechanical General Provisions, shall be made an integral part of this section.
- C. Provisions of Section 16010 - Electrical General Provisions, shall be made an integral part of this section.

1.2 WORK INCLUDED

- A. Building Control System Wiring.
- B. Interior & Exterior Lighting Control Wiring

1.3 DEFINITIONS

- A. Control Wiring: All wiring, high or low voltage other than power wiring, required for the proper operation of the mechanical systems.
- B. Power Wiring: All line voltage wiring to the mechanical equipment. Line voltage which also serves as a control circuit, such as a line voltage thermostat, or involves interlocking with a damper, shall be considered control wiring.

1.4 QUALITY ASSURANCE

- A. All work will be in accordance with the requirements of the National Electrical Code.

1.5 SUBMITTALS

- A. Submittals are not required.

PART 2 – PRODUCTS

2.1 MATERIALS

- A. All material used in the completion of the wiring under this section will comply with the requirements of Division 16 Electrical and Section 15900 - Building Control System.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Cooperate completely with the contractor for Division 16.
- B. Provide all conduit, wire and accessories necessary to complete the control wiring as specified under WORK INCLUDED.
- C. Because of variations in requirements from manufacturer to manufacturer, all details may not be included in the Contract Documents. This sub-contractor must obtain approved

coordinated wiring diagrams before proceeding with the control wiring.

- D. All control wiring shall be properly installed in an approved raceway system or when allowed, run exposed in concealed spaces. All control wiring run in exposed areas shall be in an approved raceway unless otherwise noted.
- E. Control wire run exposed shall be neatly bundled and routed parallel and/or perpendicular to building structure or equipment casing. Routing of wire shall be so that it does not interfere, chafe or obstruct service or maintenance of the equipment served.
- F. Exposed control wire shall be properly secured and/or supported within equipment enclosures. Cable shall be secured on no greater than 18" centers.
- G. All openings made for the passing of control wire shall be properly bushed to prevent chafing. Hole size shall be suitable for the quantity of wires or tubing passing through while allowing for ease of pulling and future expansion. Oversized holes beyond these requirements are not allowed.
- H. Holes made within air handling equipment which may allow the transfer or bypassing of air shall be properly sealed after wire is pulled. Expanding foam sealant and proper backing material will be acceptable. Seal shall be suitable for maximum unit operating pressures.
- I. Attachments of control devices, raceway and cable supports shall be made with proper attachments. Self-drilling screws which result in exposed end will not be acceptable. Bolts and nuts shall be used with bolt head exposed to view. All fasteners located where exposed to weather or moisture shall be stainless steel or cadmium plated.
- J. Any opening, holes or cuts in equipment enclosures or building structure not used shall be neatly sealed. On equipment, the seal or patch shall be of similar material sealed and painted to match.
- K. The control contractor shall clean all unused or scrap material from the equipment enclosure.
- L. All control wire shall be identified by proper cable identification methods. Verify how cables shall be labeled with the Owner's Representative prior to the start of work. All termination shall be labeled and labels clearly visible.
- M. All control devices, cabinets, equipment and raceways shall be labeled. Verify how the hardware shall be labeled with the Owner's Representative prior to the start of work.
- N. Splices in control wire are not allowed unless the length of run is too great to allow for a continuous run. When splices become necessary, they shall be solder connected with heat shrink tubing. When raceway is used, all splices shall be in junction boxes.
- O. Control devices (i.e., flow switches), connected to cold equipment where the possibility of condensation may occur shall be vaporproof type. The connecting conduit shall be properly sealed with spray type foam after the wires are pulled through. If this is not possible, a weatherproof junction box shall be close mounted to the device to allow for proper moisture sealing. Conduit connections shall be sealed with a silicon type caulk/sealant.
- P. All control devices or wiring located exposed to weather or moisture shall be in an approved raceway system. This system shall be properly supported and sealed to prohibit moisture convection or transfer. Provide flexible conduit similar to seal tight for

connection to all equipment. EMT and set screw fittings are not acceptable. All exterior raceway shall be IMC (Intermediate Metallic Conduit) or better with threaded fittings.

- Q. BCS Contractor to fully review the electrical drawings for interlock wiring required for exterior and interior lighting control. BCS contractor to coordinate with the electrical contractor all relays, contactors, programming and wiring required.

END OF SECTION 15058

SECTION 15060 - PIPE AND PIPE FITTINGS

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

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

1.2 WORK INCLUDED

- A. Gasoline (GS) Piping.
- B. Leakage Containment Conduit.
- C. A/C Unit Condensate Drain (CD) Piping.
- D. Domestic Water (CW/HW/HWR) Piping.
- E. Sanitary Drain, Waste and Vent (DWV) Piping.
- F. Compressed Air (A) Piping.

1.3 DEFINITIONS

- A. Pipe sizes given in this document are nominal.

1.4 QUALITY ASSURANCE

- A. All material provided under this section shall be standard catalogued products of recognized manufacturers regularly engaged in the production of such products, and shall be of the manufacturer's most recent design that is in regular production.
- B. Each item provided under this section shall meet the requirements for that item as installed and used, in accordance with the following standards:
  - 1. Metallic Piping Systems employing mechanical joints and grooved-end pipe - ASME/ANSI B-31.9
  - 2. All other metallic piping - ASME/ANSI B31.1
- C. Each piping system shall be in accordance with the system design pressures shown in paragraph 2.1 - Materials, this specification section.
- D. All materials provided under this section shall be new, except where the specifications and/or drawings permit the reuse of certain existing materials.

1.5 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this Section to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. The work and materials listed in this Section shall be provided in accordance with the standards and requirements set forth in the applicable portions of the latest editions of the referenced publications.

- C. All cast iron soil pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute (CISPI) and be listed by NSF International.
1. American National Standards Institute (ANSI) Standards
  2. American Petroleum Institute (API) Specification
  3. American Society of Mechanical Engineers (ASME) Publications
  4. American Society for Testing and Materials (ASTM) Publications
  5. American Welding Society (AWS) Publication
  6. American Water Works Association (AWWA) Standards
  7. Cast Iron Soil Pipe Institute (CISPI) Standards
  8. The Manufacturer's Standardization Society of the Valve and Fittings Industry (MSS) Publications
  9. National Fire Protection Association (NFPA) Standards
  10. National Sanitation Foundation (NSF) Testing Laboratory Standards.
  11. Plastic Pipe Institute (PPI) Manual.
  12. Underwriters Laboratories (UL)

#### 1.6 SUBMITTALS

- A. Submit a list identifying the specific type of material that will be used for each piping system. Include pipe, fittings, valves, hangers and supports. Include the designation of the publication applicable for each type of material and method.
- B. Submit a letter from the refrigeration equipment manufacturer stating that the refrigeration piping system, as shown on the contract documents, is acceptable for the equipment the manufacturer proposes to furnish, or submit drawings prepared by an authorized representative of the refrigeration equipment manufacturer.

### PART 2 – PRODUCTS

#### 2.1 MATERIALS

- A. Fuel (FS) Piping.  
System Design Pressure: 65 psig.
1. Piping - all sizes: Manufactured by the filament-winding process using a thermosetting epoxy resin to impregnate strands of continuous glass filaments around a mandrel at a fixed helix angle of 30-40 degrees, under controlled tension.
  2. All pipes: Supplied with a matched tapered bell-and-spigot joining system.
  3. The pipe shall have a continuous steady pressure rating of 225 psig @ 210°F, in accordance with ASTM D2992.
  4. Fuel piping, where required by NFPA or applicable building codes, shall be encased in a Leak Containment Conduit.
- B. Leak Containment Conduit.  
System Design Pressure: 100 psig.
1. Conduit - all sizes: FRP Piping, Manufactured by the filament-winding process using a thermosetting epoxy resin to impregnate strands of continuous glass filaments around a mandrel at a fixed helix angle of 30-40 degrees, under controlled tension.
  2. All pipes: Supplied with a matched tapered bell-and-spigot joining system.
  3. The pipe shall have a continuous steady pressure rating of 225 psig @ 210°F, in accordance with ASTM D2992.

- C. A/C Unit Condensate Drain (D) Piping.  
System Design Pressure: 10 psig.  
(Where two materials are listed, either may be used.)
1. Drains, Indoor, not in Return Air Plenums - PVC:
    - a. Schedule 40 Polyvinyl Chloride (PVC), ASTM D1785.
    - b. Schedule 40 PVC, socket-type, ASTM D2466. Joints shall be made with solvent cement, ASTM D2564.
- D. Domestic (Potable) Water (CW/HW) Piping  
System Design Pressure: 150 psig.
1. Piping, 8" and smaller - Above grade, copper tube, Type "L", hard temper, ASTM B88. Wrought copper or bronze fittings, solder joint, pressure rated, ASTM B16.22-95; or cast bronze fittings, solder joint, pressure rated, ASME B16.18-R94.
  2. Piping, 4" and smaller - Below grade, copper tube, Type "K", hard temper, ASTM B88. Wrought copper or bronze fittings, solder joint, pressure rated, ASTM B16.22-95; or cast bronze fittings, solder joint, pressure rated, ASME B16.18-R94.
  3. One-half inch (1/2") trap primer wastewater feed line to floor drains, same as domestic water, Type "L", except soft-drawn copper.
  4. Temperature and pressure relief lines and drain pan lines same as domestic water, Type "L" hard-drawn copper or CPVC if not in a return air plenum.
  5. Hot water (temperatures up to 140 deg F) and cold water 1/2" size through 2" may be chlorinated poly (vinyl chloride), CPVC 4120, SDR 11, plastic tube and socket type fittings, ASTM D2846, ASTM F402, ASTM F493, CSA B137.6-M1983, CSA B137.16-M1983 as manufactured by Thompson Plastics, Inc., "Flow Guard Gold", or approved equal, if not located in a return air plenum.
  6. Pipe Fittings, 8" and smaller - Above ground installation may be:
    - a. Wrought Copper, ANSI B16.22.
    - b. ProPress Fitting: Copper press fittings shall conform to the material and sizing requirements of ASME B16.18 or ASME B16.22.
    - c. Mechanical joints employing victaulic roll grooved-end pipe may be used on this piping system. See Paragraph 2.2 "Mechanical Joint Systems", this section, for specifications.
    - d. Mechanically formed tee fitting, as created by T-Drill, is an acceptable method of installation.
  7. Pipe Fittings, 4" and smaller - Below ground installation: Wrought Copper, ANSI B16.22.
  8. Solder for factory fabricated fittings: Lead-free per FPC.
  9. Brazing for Mechanically formed tee fittings: Brazing may be:
    - a. 5% silver, 6% phosphorus, balance copper, 1190°F melting point. AWS A5.8 number BCuP -3. J.W. Harris Stay-Silv® 5 or equal.
    - b. 15% silver, 5% phosphorus, balance copper, 1190°F melting point. AWS 5.8 number BCuP-5. J.W. Harris Stay-Silv® 15 or equal.
    - c. 6% silver, 6.1% phosphorus, balance copper, 1190°F melting point. QQ-B-654A number BCuP -5. J.W. Harris Dynaflow® 5 or equal
  10. Bolts for ductile iron mechanical joints shall be square-headed, carbon steel,

ASTM A-307, Grade B. Nuts shall be heavy-duty hex type full nuts; ASTM A-194, Grade 2.

11. "Pro-Press" or approved copper system is acceptable.

E. Sanitary Drain, Waste and Vent (DWV) Piping:

1. Underground sanitary piping:

- a. No-hub cast iron pipe and fittings, CISPI Standard 301, ASTM A-888-98el.
- b. Service weight hub and spigot pipe and fittings, Fed. Spec. WW-P-401F, ASTM-A74-98, CISPI-301.
- c. No-hub couplings, CISPE Standard 310-97.
- d. Charlotte Seal Gaskets, ASTM C-564-97, CISPI-HSN.
- e. Warco-Quik-Tite Gaskets, ASTM C-564-94, CISPI-HSN.
- f. Schedule 40, PVC-DWV drainage pattern, conforming to the following standards:
  - 1) ASTM D-1784 – Rigid PVC Vinyl Components.
  - 2) ASTM D-1785 – PVC Plastic Pipe, Schedule 40.
  - 3) ASTM D-2665 – PVC Drain, Waste and Vent Pipe and Fittings.
  - 4) ASTM D-2564 – Solvent Cements for PVC Pipe and Fittings.
  - 5) NSF Standard 14 – Plastic Piping Components and Related Materials.
- g. PP Schedule 40 polypropylene, ASTM D635 and ASTM F1412, drainage pattern, mechanical joint stainless steel components, ASTM B117. Polypropylene shall be used where indicated on the drawings and as specified herein.

2. Above-ground sanitary and vent piping:

- a. No-hub cast iron pipe and fittings, CISPI Standard 301, ASTM A-888-98el.
- b. Service weight hub and spigot pipe and fittings, Fed. Spec. WW-P-401F, ASTM-A74-98, CISPI-301.
- c. No-hub couplings, CISPI Standard 310.
- d. Charlotte Seal Gaskets, ASTM C-564, CISPI-HSN.
- e. Warco-Quik-Tite Gaskets, ASTM C-564-97, CISPI-HSN.
- f. 2" and smaller Type DWV hard-drawn copper tubing, ASTM B-306 with copper drainage pattern and (lead-free) solder 95-5 Tin-antimony.
- g. Schedule 40, PVC-DWV drainage pattern, conforming to the following standards:
  - 1) ASTM D-1784 – Rigid PVC Vinyl Components.
  - 2) ASTM D-1785 – PVC Plastic Pipe, Schedule 40.
  - 3) ASTM D-2665 – PVC Drain, Waste and Vent Pipe and Fittings.
  - 4) ASTM D-2564 – Solvent Cements for PVC Pipe and Fittings.
  - 5) NSF Standard 14 – Plastic Piping Components and Related Materials.

3. PVC Foam core DWV pipe, ASTM F891, is not and shall not be approved under any circumstances nor installed on this project.

F. General Compressed Air (A) Piping



System Design Pressure: 100 psig

1. Piping, 1/2" thru 2": Type L Hard-drawn Copper Tubing: ASTM B88.
2. Piping, 2-1/2" thru 4": Contractor's option:
  - a. Type L Hard-drawn Copper Tubing: ASTM B88.
  - b. Schedule 40 carbon steel, seamless, galvanized; ASTM A-106, Grade B, Type S.
3. Piping, 5" thru 10": Schedule 40 carbon steel, seamless or electric resistance welded, ASTM A-53, Grade B, Type S or ERW.
4. Pipe Fittings, 1/2" thru 2": Wrought Copper, ANSI B16.22.
5. Pipe Fittings, 2-1/2 thru 4": Contractor's option:
  - a. Wrought Copper, ANSI B16.22.
  - b. Pipe Fittings, 2-1/2 thru 4": 150 lb. malleable iron, threaded type, galvanized; ASTM A-197.
  - c. Mechanically formed tee fitting, as created by T-Drill, is an acceptable method of installation.
6. Pipe fittings 5" and larger: Schedule 40 carbon steel, butt weld type, ASTM A-234.
7. Brazing for Mechanically formed tee fittings: Brazing: Contractors Option:
  - a. 5% silver, 6% phosphorus, balance copper, 1190°F melting point. AWS A5.8 number BCuP -3. J.W. Harris Stay-Silv® 5 or equal.
  - b. 15% silver, 5% phosphorus, balance copper, 1190°F melting point. AWS 5.8 number BCuP-5. J.W. Harris Stay-Silv® 15 or equal.
  - c. 6% silver, 6.1% phosphorus, balance copper, 1190°F melting point. QQ-B-654A number BCuP -5. J.W. Harris Dynaflo® 5 or equal
8. Unions:
  - a. 1/2" thru 4": Wrought Copper, Pressure Class 150, w/solder ends.
  - b. Note: Dielectric unions shall be used to connect copper to steel pipe, and shall have metal connections on each end threaded to match the adjacent piping. Metal components shall be separated by a nylon insulator to prevent current flow between dissimilar metals. Unions shall be suitable for the system operating pressures and temperatures.
9. Flanges 2-1/2" thru 4": Contractor's option:
  - a. 125 lb. rated cast bronze, single-piece, flat-faced, with solder connections, ASTM B62, ANSI B16.24.
  - b. 150 lb. rated forged carbon steel, galvanized, weld neck type, with raised face, bored to match the mating pipe I.D., ASTM A-181, Grade 2, or ASTM A-105, Grade 2.
10. Bolting studs: ASTM A-193, Grade B7. Nuts shall be heavy duty hex type; ASTM A-194, Grade 2H.
11. Gaskets and Bolting:
  - a. Gaskets used with cast bronze flanges shall be neoprene. Gaskets shall have a non-blooming surface, a Durometer hardness of 75 (+/- 5), a tensile strength of not less than 2500 psi, and compression recovery of

- 50 percent. The gasket material shall be in accordance with ASTM F104 Line Call-out F712400A9E34K5M9. Based on Garlock Style 3300 or acceptable equivalent.
- b. Gaskets used with steel flanges: Spiral wound type, 304 stainless steel, with non-asbestos filler, with solid metal compression control ring; Garlock Flexseal® Style RWI or acceptable equivalent.
  - c. Bolts for cast bronze flanges shall be square-headed, carbon steel; ASTM A-307, Grade B.
  - d. Bolting studs for steel flanges: ASTM A-193, Grade B7, Nuts shall be heavy-duty hexagonal type, ASTM A-194, Grade 2H.
12. Mechanical joints employing grooved-end pipe may be used on this piping system. See Paragraph 2.2 "Mechanical Joint Systems", this section, for specifications.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

##### A. General:

1. Furnish and install piping, fittings and appurtenances required to complete the piping systems shown on the drawings. Elbows shall be long radius type. Tees may not be field fabricated.
2. Run piping to true alignment, generally parallel or perpendicular to building walls, floors and ceilings, and with uniform grades and spacing, so as to present a neat and workmanlike appearance.
3. Care shall be paid to the exact locations of piping with respect to equipment, ducts, conduits, slabs, beams, lighting fixtures, columns, ceiling suspension systems, etc. to provide maximum access to mechanical and electrical equipment in the building. Close coordination and cooperation shall be exercised with other trades in locating the piping in the best interests of the Owner. The drawings and specifications covering other work to be done in the building shall be carefully studied and arrangements made to avoid conflict.
4. Not all necessary pipe offsets are indicated on the drawings because of the small scale. The various runs of piping to be installed shall be studied and adjustments made in exact routings as may be required for proper installation.
5. Conflicts arising during the erection of piping shall be brought to the attention of the Owner's Representative. No improvising or field changes will be permitted without the approval of the Owner's Representative.
6. Use full lengths of pipe wherever possible. Short lengths of pipe with couplings will not be permitted. Cut to exact measurement and install without forcing or spring unless otherwise shown on the drawings or specified.
7. Avoid tool marks and unnecessary pipe threads. Burrs formed when cutting pipe shall be removed by reaming. Before installing any pipe, care shall be taken that the inside is thoroughly cleaned and free of cuttings and foreign matter. Measures shall be taken to preserve this cleanliness after erection.
8. Arrange pipe connections to valves and specialties so that there is clearance for easy removal of the valve or specialty from the line, and also for the removal of the valve bonnet and interior, and the specialty top and bottom and interior, except where otherwise approved by the Owner's Representative.
9. Erect piping in such a manner so as to obtain sufficient flexibility and to prevent excessive stresses in materials and excessive bending movements at joints or connections to equipment. Make allowances throughout for expansion and contraction of piping. Provide each riser and horizontal run of piping with

- expansion loops, expansion joints, or expansion compensators where indicated and required. Securely anchor and adequately guide pipe as required or where indicated to force expansion to the expansion device without bending, binding, or misalignment of pipe. Branch connections from mains to risers shall be made with ample swing or offset to avoid undue strain on fittings or short pipe lengths. Where indicated, in lieu of expansion loops, expansion joints, or expansion compensators, horizontal runs of pipe shall be anchored at approximately midway of the run to force expansion, evenly divided, toward the mains and risers to provide for expansion and contraction of piping. Flexibility shall be provided by installing one or more turns in the line so that piping will spring enough to allow for expansion without straining.
10. Installed piping shall not interfere with the operations or accessibility of doors or windows and shall not encroach on aisles, passageways and equipment, and shall not interfere with the servicing or maintenance of any equipment. Adjacent pipelines shall be grouped in the same horizontal or vertical plane.
  11. Where lines are purposely pitched for drainage, an accurate grade shall be maintained. No lines shall be supported in such a manner as to permit deflection, due to gravity, sufficient to pocket the lines when full of liquid. Grade mains as indicated by arrows on the drawings and in accordance with gradient as indicated in attached Piping Schedule.
  12. Piping found to have water hammer or other objectionable vibrations which cannot be eliminated by proper grading or other natural means, shall be braced, trapped or hung with shock absorbing hangers and equipped with air chambers, mechanical shock absorbers, flexible pipe connections or otherwise silenced using approved means.
  13. Use building steel wherever possible for supporting pipe hangers. Main structural steel shall not be drilled, cut or burned for hangers without the approval of the Owner's Representative. Expansion bolts shall be used only upon the approval of the Owner's Representative.
  14. Install unions or flanges in piping connections to equipment, regulating valves, and wherever necessary to facilitate the dismantling of piping and/or removal of valves and other items requiring maintenance.
  15. Avoid bushings. Reducing fittings shall be used wherever practical.
  16. The drawings indicate the size of piping and connections, and if certain sizes are omitted or unclear, obtain additional information before proceeding.
  17. The piping drawings have been worked out with a view to the most economical installation, taking into consideration accessibility and appearances, and the Contractor must follow the drawings accurately and if it is found impractical to install the work in accordance with the drawings and specifications, the Contractor shall notify the Owner's Representative before making any changes and get their approval or revised drawings before proceeding with the work. Verify all measurements on the job before cutting pipes or having piping fabricated, and be responsible for the correct location of all pipe connections, also check sizes and standard of outlets on the equipment, including the dimensions and drilling of flanges, etc.
  18. Copper tubing and galvanized steel shall not be mixed in any one run of piping.
  19. Change in direction shall be made with fittings, except that bending of steel and copper pipe 4 inches and smaller will be permitted, provided a pipe bender is used and wide sweep bends are formed. The center-line radius of bends shall be not less than 6 diameters of the pipe. Bent pipe showing kinks, wrinkles, flattening, or other malformations is not acceptable.
  20. Threaded joints shall be made with tapered threads in accordance with ANSI B2.1, and made tight with an approved pipe thread joint compound or material, applied to the male threads only. Use compounds sparingly and apply with caution to ensure that compounds do not enter piping systems. When pipe joint

is made up a maximum of 3 threads shall be visible.

21. Joints for plastic pipe shall be made in accordance with PPI Piping Manual.
22. Connections between ferrous and nonferrous metallic pipe shall be made with dielectric unions or flanges.
23. Connections between plastic and metallic pipe, between plastic and glass pipe, and between metallic and glass pipe, shall be made with transition fittings manufactured for the specific purpose.
24. Unions and flanges shall not be concealed in walls, partitions, or above inaccessible ceilings.

B. Hydronic HVAC Systems Additional Requirements:

1. Provide water seal in the condensate drain from each air handling or air conditioning unit. The depth of each seal shall be equal to the total static pressure rating of the unit to which the seal is connected. Water seals shall be constructed of two tees and an appropriate U bends with the open end of each tee plugged.

C. Plumbing Systems Additional Requirements:

1. Bends, plugs, or tees in water service lines, except soldered or screwed joints, shall be braced or clamped. The connection between the water service line and the domestic water distribution line shall be anchored by means of tie rods and pipe clamps.
2. Before connecting the domestic water system to underground supply connections, each supply connection shall be thoroughly flushed of all foreign matter.
3. Vertical cast iron soil pipe hubs inside buildings shall extend 6 inches above concrete slab-on-grade floors.
4. Provide test tees with screwed plugs in waste and vent systems to isolate sections of system previously tested from section of system under test. Distance between test tees on vertical lines shall not exceed static height allowable for system pressure limitations. All joints in test tees, including plugs, shall be tested under pressure as specified for system tests.
5. Joints between cast-iron pipe and copper tube shall be made by using a brass-caulking ferrule and properly soldering the copper tube to the ferrule prior to pouring the lead.
6. Joints between cast-iron and vitrified clay piping shall be made using either hot-poured bitumastic compound, or by a preformed elastomeric ring conforming to ASTM C564. The ring shall, after ramming, completely fill the annular space between the cast-iron spigot and the vitrified clay hub.
7. Joints between copper tubing and threaded pipe shall be made by the use of brass adapters or dielectric fittings. The joint between the copper tubing and the fitting shall be soldered, and the connection between the threaded pipe and the fitting shall be a standard pipe size screw joint.
8. Joints between steel and cast-iron pipe shall be either caulked or threaded, or made with approved adapter fittings.
9. Install horizontal drainage piping in uniform alignment at uniform slopes that will produce a computed velocity of not less than 2 feet per second when flowing half full, or a minimum of 1/8" per ft. unless noted otherwise.
10. The underground water service pipe and the building sewer shall be not less than 6 feet apart horizontally, and shall be separated by undisturbed, or compacted, earth, unless the following requirements are satisfied:
  - a. The water service pipe and the building sewer may be installed in the

same trench, provided written approval is given by the plumbing official and the following conditions are met:

- 1) The bottom of the water service pipe at all points shall be not less than 12 inches above the top of the sewer line at its highest point.
  - 2) The water service pipe shall be placed on a solid shelf excavated at one side of the common trench.
  - 3) The number of joints in the service pipe shall be kept to a minimum.
  - 4) The materials and joints in the sewer pipe shall be installed in such manner, and shall possess the necessary strength and durability, to prevent the escape of solids, liquids, and gases there from under all known adverse conditions such as corrosion, strains due to temperature changes, settlements, vibration, and superimposed loads.
  - 5) Where the water service line must cross the building sewer line, the bottom of the water service line within 10 feet of the point of crossing shall be at least 12 inches above the top of the sewer line. The sewer line shall be of cast iron, with leaded or mechanical joints, within 10 feet of the point of crossing.
  - 6) Domestic water lines shall be disinfected in accordance with Section 15480 - DISINFECTION OF DOMESTIC WATER LINES.
11. Provide access panel for all valves located above non-accessible ceiling. Coordinate with Architectural plans for exact locations.
  12. Provide clean-outs at the base of all sanitary waste and vent stacks.
  13. Installation of copper tubing shall be per FPC, ASTM B32-96, and per Copper Development Association and ASTM B828-92-E01.
  14. Install plugs or caps on all openings during the construction phase. The temporary plug shall be cap of same material as pipe. Duct tape is unacceptable for use as a plug for the construction phase.
  15. All penetrations of piping through walls shall be made insect proof, (i.e., penetrations of waste arms, hot and cold water piping through walls below sinks, lavatories, water closets, etc.). The escutcheon plate does constitute an "insect proof" closure.
  16. Mechanically formed branch connections, commonly termed extruded outlets, shall be made in a continuous operation consisting of producing a pilot hole, drawing out the tube/pipe surface to form an outlet and facing of the outlet rim (including beveling when required). An integral pipe heating operation may be included, after the cutting of the pilot hole on Schedule 40 wall thickness. The outlet device shall be fully adjustable to insure proper tolerance and complete uniformity of the joint. Materials should have a minimum elongation of 20-25% to be acceptable for forming.
  17. The extruded outlet and butt weld connection shall be in accordance with ASME Boiler and Pressure Vessel Code, as listed under ANSI B31 Standards.
- D. General Compressed Air Systems Additional Requirements:
1. Provide bucket, or float type drain traps at base of main risers. Pipe trap discharge to floor drain, or other suitable location.
  2. Branch connections shall be made on the top of main for both up-feed and down-feed applications.

E. Plastic Pipe Systems Additional Requirements:

1. Joints between plastic pipe and other materials shall be subject to the following requirements:
  - a. Joints between different grades of plastic pipe shall be made by use of an approved adapter fitting.
  - b. Joints between the hub of cast-iron soil pipe and plastic pipe shall be made by use of a mechanical joint of the compression or mechanical sealing type.
  - c. Joints between plastic pipe and cast-iron pipe, steel pipe, glass pipe, copper tube, and other piping materials shall be made by use of an approved adapter fitting.
2. Plastic pipe, fittings, and solvent cement used for domestic hot and cold water service shall bear the NSF seal for potable water.
3. Plastic pipe, fittings, and solvent cement shall not be used in systems where temperature, and operating pressure plus system static head, exceeds materials temperature and pressure limitations.
4. Plastic vent piping shall not pass through roofs, firewalls, or fire partitions. Plastic waste and vent piping shall be installed in fire rated pipe chases when passing through floors or approved fire stop sleeve.
5. Plastic piping materials shall not be installed in air plenums, air chambers, or airshafts.

F. Underground Petroleum Products Piping Additional Requirements:

1. Provide a pipe system, complete with all piping, tools, and accessories for a proper and safe installation, in accordance with the current EPA regulations, to prevent contamination of ground in the event of a rupture or leak in fluid carrier pipe.
2. Provide a 'Marker Tape', located 6" below finished grade, above all underground petroleum products piping.
3. The piping system shall be compatible with Section 15605 - Fuel Storage Tank and Accessories.
4. Provide filter fabric barrier at bottom of piping excavation for containment in event of pipe leak.
5. Piping shall be in accordance with FDEP Chapter 62-761.
6. All equipment shall be on the FDEP approved list.

3.2 BRAZING AND SOLDERING

- A. Operator and Procedure Qualifications: All brazing operators and all brazing procedures shall be qualified in accordance with the requirements of Section IX of the ASME Boiler and Pressure Vessel Code.
- B. Brazing:
  1. Silver braze joints in accordance with MSS-SP-73 "Silver Brazing Joints for Wrought and Cast Solder Joint Fittings".
- C. Soldering:
  1. Joints in copper tubing shall be made with solder- type fittings. Outside surface

of the tube where engaged in the fitting, and inside surface of the fitting in contact with the tube, shall be cleaned with an abrasive material before soldering. Self-cleaning compounds shall not be used. Care shall be taken to prevent annealing of tube and fittings when making connections. The solder joint shall be made with flux and wire form solder, except brazed joints. The flux shall be a mildly corrosive liquid or a petroleum based paste containing chlorides of zinc and ammonium. Solder shall be applied and drawn through the full fitting length. Excess solder shall be wiped from joint before solder hardens. Joints in copper tube sizes 2-1/2 inches and larger shall be made with heat applied uniformly around the entire circumference of the tube and fittings by a multi-flame torch. Use of oxy-acetylene cutting torch in lieu of multi-flame torch is not permitted. Disassemble valves and other accessories that may be damaged by heat before soldering.

- F. Piping Identification: All piping shall be marked in accordance with the provisions of Section 15050 - BASIC MATERIALS AND METHODS.

### 3.3 TESTING OF PIPING SYSTEMS:

- A. Each piping system, after erection, shall be subjected to a pressure test. The test requirements shall be as follows and fully comply with ANSI B31.9-2008 Chapter VI section 937:
1. General: Furnish everything required for the tests. Notify Architect/Engineer at least 48 hours before any testing is performed. Independent Agent/Owner shall verify pressure test and sign off. Report to be furnished to Architect/Engineer. Testing shall be performed at the completion of each phase of the project.
  3. Gravity plumbing systems shall be tested with water at not less than a 10 foot head. The water shall be kept in the systems for a period of not less than 15 minutes prior to start of visual examination. In lieu of water test, the systems may be tested with air at a uniform pressure of 10 psig, with no loss in pressure for a period of not less than 30 minutes.
  4. The building sewer shall be tested by insertion of a test plug at the point of connection with the public sewer, and filled with water under a head of not less than 20 feet, with no drop in water level for a period of not less than 15 minutes.
  5. Domestic Water Distribution Systems shall be tested with water at the system working pressure, but not less than 150 psig. Joints will be visually examined for leaks.
  6. Domestic Water Distribution Systems utilizing Viega Pro-Press fittings with SC Feature Contour Design shall be initially tested at a minimum of 1/2 psig but not more than 85 psig. Joints shall be visually examined for leaks.
  7. Domestic Water Service System shall be tested with water at 150 psig. Joints will be visually examined for leaks.
  8. Compressed Air Systems shall be tested with air at the system working pressure, but not less than 100 psig, with no drop in gauge pressure for a period of not less than 30 minutes.
  9. Leaks, if any, shall be located, repaired, and retested in accordance with the test method specified for the system in which the leaks are located.
- B. Prior to testing a system, the Contractor shall provide the proper Building Official and the Owner's Representative with not less than 72 hours notice of the proposed test. The Contractor shall obtain approval of the test results. Where written approval is required, the Contractor shall obtain such written approval, and submit a copy of the approval.
- C. Work requiring testing shall not be covered, or otherwise concealed, until testing is

completed and approval is granted.

- D. Work, or portions of work, that is altered in any way after testing and approval shall be retested, witnessed, and approval obtained.
- E. Systems requiring hydrostatic tests shall be protected from damage caused by freezing. After tests are completed drain all sections of pipe, including traps, or fill undrained sections and traps with antifreeze solution. Vent all high points to release vacuum and ensure complete drainage of closed systems, and blow out piping with compressed air to remove trapped water.
- F. Duration of tests, unless specified otherwise, shall be the time required to examine each joint in the system being tested.
- G. Systems requiring hydrostatic testing under pressure shall be vented at high points to ensure that all piping is completely filled with the testing medium.
- H. Disconnect pressure boosting apparatus, and vacuum pumps, during the test time span specified for systems employing the pressure loss/time span test method.
- I. During tests, isolate system components that have test pressures less than pressures specified for system tests.
- J. Use clean soapy water applied to exterior of joints to locate leaks in systems using compressed air, dry carbon dioxide, or nitrogen, under positive pressure as a test medium.

#### 3.4 CLEANING OF PIPING SYSTEMS

- A. Plumbing piping systems shall be thoroughly cleaned as described in Section 15480 - Disinfection of Domestic Water Lines. The chlorination and disinfections process shall be witnessed by a representative of the owner and provide a written Certification, as such.

END OF SECTION 15060



**SECTION 15090 - SUPPORTS, HANGERS, ANCHORS AND SLEEVES**

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Provisions of Section 15010, Mechanical General Provisions, shall be made an integral part of this section.

1.2 WORK INCLUDED

- A. Inserts, Shells and Upper Attachments.
- B. Pipe Hangers, Rods, Supports and Accessories.
- C. Pipe Sleeves.
- D. Pipe Seals.
- E. Duct Hangers and Supports.
- F. Duct Sleeves.
- G. Fabricated Steel Supports.

1.3 QUALITY ASSURANCE

- A. Design of pipe supporting elements shall be in accordance with ANSI B31.1.
- B. Fabrication and installation of pipe hangers and supports shall be in accordance with the following Manufacturers Standardization Society (MSS) Standards.
  - 1. SP-58 Pipe Hangers and Supports: Materials, Design and Manufacture.
  - 2. SP-69 Pipe Hangers and Supports: Selection and Application.
  - 3. SP-89 Pipe Hangers and Supports: Fabrication and Installation Practices.
- C. Steel angles, channels and plate shall be in accordance with ASTM A36, red primed or hot dipped galvanized for interior applications, and hot galvanized for exterior applications.
- D. Bolts, including nuts and washers, used for fabricating steel members shall be in accordance with ASTM A325 and shall be stainless steel or plated for corrosion protection. Plain steel components are unacceptable.
- E. Welding of steel members shall be in accordance with AWS D1.1.
- F. Duct hangers and supports shall be in accordance with SMACNA HVAC Duct Construction Standards – Metal and Flexible as applicable.
- G. Steel supports for ducts, pipe anchors, pipe guides, and piping supported from below shall be fabricated in accordance with AISC Specification for the Design, Fabrication and Erection of Structural Steel for buildings. If required, the contractor shall include the cost of the services of a structural engineer to design or review the system.

#### 1.4 APPLICABLE PUBLICATIONS

- A. Applicable sections of the publications listed below form a part of this Section. The publications are referenced to in the text by the basic designation only.
1. American Institute of Steel Construction (AISC)
  2. American National Standards Institute (ANSI)
  3. American Society for Testing and Materials (ASTM)
  4. American Welding Society (AWS)
  5. The Manufacturer's Standardization Society of the Valve and Fittings Industry (MSS)
  6. Sheet Metal and Air Conditioning Contractor's National Association, Inc. (SMACNA)

#### 1.5 SUBMITTALS

- A. Submit schedule indicating type of hanger to be used by system and pipe size. Include rod size for each hanger size.
- B. Product data, along with installation operation and maintenance instructions, shall be included in the operation and maintenance manuals.

### PART 2 - PRODUCTS

#### 2.1 ACCEPTABLE MANUFACTURERS

- A. Inserts, Shells and Upper Attachments:
1. Anvil International, Inc.
  2. Carpenter Paterson, Inc.
  3. Cooper B-Line®, Inc.
  4. Elcen Metal Products
  5. Hilti
  6. Michigan Hanger Company
  7. PHD Manufacturing, Inc.
  8. Unistrut®
- B. Pipe Hangers, Rods, Supports and Accessories:
1. Anvil International, Inc.
  2. Carpenter Paterson, Inc.
  3. Cooper B-Line®, Inc.
  4. Elcen Metal Products
  5. Hilti
  6. Michigan Hanger Company
  7. PHD Manufacturing, Inc.
  8. Unistrut®
- C. Pipe Sleeves:
1. Metraflex – Metraseal
  2. Thunderline Corporation - Link Seal
  3. Owner Approved Equal.

- D. Pipe Seals:
  - 1. Metraflex – Metraseal
  - 2. Thunderline Corporation - Link Seal
  - 3. Owner Approved Equal.
- E. Duct Hangers and Supports: Fabricated per Specifications
- F. Duct Sleeves: Fabricated per Specifications
- G. Fabricated Steel Support: As Detailed on Drawings.

## 2.2 FABRICATION

- A. Inserts, Shells and Upper Attachments:
  - 1. Inserts; MSS Type 18; malleable iron body and nut, galvanized finish, opening in top of insert for reinforcing rod, lateral adjustable. Rated for 1,140 lbs. Based on Anvil Fig. 282 or approved equal.
  - 2. Shells: Steel shell and expander plug, snap off end fastener. Based on Phillips Concrete Fasteners Red Head or approved equal.
  - 3. Upper Attachments:
    - a. Top beam clamps; MSS Type 19: Malleable iron galvanized finish clamp, hardened steel cup point set screw and locknut. Rating is contingent on rod and bolt size. Based on Anvil Fig. 94 or approved equal.
    - b. Bottom Beam Clamp; MSS Type 23: Malleable iron galvanized finish clamp, hardened steel cup point set screw and locknut, and retaining clip. Rating is contingent on rod and bolt size. Based on Anvil Fig. 86 Clamp and Fig. 89 Retaining Clip (or Fig. 87) or approved equal.
    - c. Welded Beam Attachment; MSS Type 22: Carbon steel suitable for eye rod or rod and locknut, rating is contingent on rod and bolt size. Based on Anvil Fig. 66 or approved equal.
    - d. Center Beam Clamp; MSS Type 21: Malleable iron jaw and square head bolt and nut with galvanized finish. Rating is contingent on rod and bolt size. Based on Anvil Fig. 134 or approved equal..
    - e. Center Beam clamp; MSS Type 29: Forged steel, weldless eye nut, tie rod to secure clamp to beam all with galvanized finish, rating is contingent on rod and bolt size. Based on Anvil Fig. 292 or 292L or approved equal.
- B. Pipe Hangers, Rods, Supports and Accessories:
  - 1. Pipe Hangers:
    - a. Clevis Hanger; MSS Type 1: Carbon steel, galvanized for interior and exterior use, sized to accommodate required insulation. Rating is contingent on rod and bolt size. Based on Anvil Fig. 260 or 300 or approved equal.
    - b. Pipe Rings; MSS Type 10: Carbon steel, galvanized for black steel and insulated pipe copper or copper plated or rubber coated for copper pipe. Threaded swivel, sized to accommodate required insulation. Rating is contingent on rod and bolt size. Based on Anvil Fig. 69 or Fig. 97C for copper pipe or approved equal.
    - c. Adjustable Roller Hanger; MSS Type 43: Cast iron roll, carbon steel

yoke rod roll and hex nut with galvanized finish. Sized to accommodate insulation. Rating is contingent on rod and bolt size. Based on Anvil Fig. 181 or approved equal.

2. Rods:

- a. Size 3/8" and up: All thread steel rod electro galvanized. Sizing for pipe or equipment support as follows:

Copper Tube, Plastic Fiberglass Reinforced <u>Pipe Size</u>	Steel, Cast Iron or Glass <u>Pipe Size</u>	<u>Rod Size</u>	Max Equip. <u>Load</u>
1/4" to 2"	1/4" to 2"	3/8"	730 lbs.
2-1/2" to 5"	2-1/2" to 3"	1/2"	1350 lbs.
6"	4" to 5"	5/8"	2160 lbs.
8" to 12"	6"	3/4"	3230 lbs.
14"	8" to 12"	7/8"	4480 lbs.
16"	14" to 16"	1"	5900 lbs.
18" to 20"	18" to 20"	1-1/4"	9500 lbs.
22" to 42"	22" to 42"	1-1/2"	13,800 lbs.

- b. Rods may be reduced one size for double rod hangers with 3/8" minimum diameter, or when other paragraphs require a minimum of 2 hangers per section provided the minimum diameter of 3/8" in maintained. Based on Anvil Fig. 146 or approved equal.

3. Supports:

- a. Pipe Saddle; MSS Type 38: Cast iron saddle, black steel lock nut nipple, cast iron reducer all with galvanized finish. Suitable for standard field cut and threaded galvanized steel pipe. Cast iron floor flange. Based on Anvil Fig. 264 Saddle, Fig. 63 Floor Flange or approved equal.
- b. Pipe Saddle Cold Piping; MSS Type 40. Single bonded unit consisting of a galvanized metal shield and a molded section of rigid polyurethane foam insulation. Rigid urethane foam shall have a density of 4 pounds per cubic foot, a thermal conductivity of 0.13 Btu.in/sq.ft./hr.°F at 75°F mean temperature. Insulation thickness to be equal to thickness specified for pipe being supported.
- c. Adjustable Pipe Roll and Base; MSS Type 46: Cast iron base plate steel stand and roll, adjusting screws with galvanized finish. Based on Anvil Fig. 274 or approved equal.
- d. Welded Steel Bracket; MSS Type 32: Welded carbon steel rate for 1500 lbs., with galvanized finish. Rating is contingent on rod and bolt size. Based on Anvil Fig. 195 or approved equal.
- e. Riser Clamps; MSS Type 8: Carbon steel, galvanized finish for black steel or galvanized pipe, plastic coated for cold steel, copper, glass or brass pipe rated for a minimum of 220 lbs. at 3/4" size. Based on Anvil Fig. 261 or approved equal.

4. Accessories:

- a. Protective Shields; MSS Type 40: Carbon steel, galvanized minimum of 12" length sized for required insulation. Based on Anvil Fig. 167 or approved equal.
- b. Protective Saddles; MSS Type 39: Carbon steel plate, minimum of 12" length, sized for required insulation. Based on Anvil Fig. 160 thru 165 or

- c. approved equal.  
Steel Turnbuckle; MSS Type 13: Forged steel, galvanized finish with locknuts. Rated at a minimum of 730 lbs. at 3/8" size. Based on Anvil Fig. 230 or approved equal.
  - d. Steel Clevis; MSS Type 14: Forged steel, galvanized finish with steel pin and cotter pin. Rated for a minimum of 730 lbs. at 3/8" size. Based on Anvil Fig. 299 or approved equal.
  - e. Weldless Eye Nut; MSS Type 17: Forged steel, galvanized finish. Rated for a minimum of 730 lbs. at 3/8" size. Based on Anvil Fig. 290 or 290L or approved equal.
- C. Pipe Sleeves:
- 1. Wall: Schedule 40 carbon steel pipe sized to accommodate pipe, insulation and firestopping. See Division 7 for firestopping. If sleeves are field cut coat cut edges with cold galvanizing spray, ZRC or equivalent.
  - 2. Floor or Exterior Walls below Grade: Schedule 40 steel pipe with anchor and water stop hot dip galvanized after fabrication. Sized to accommodate pipe and waterproofing or firestopping. Refer to Division 7 for firestopping requirements. Sleeve length will be sized to allow a minimum of 1/2" extension below floor or exterior side of a wall below grade and 1-1/2" extension above floor and 1/2" extension on interior side of an exterior wall below grade.
  - 3. Roof: All penetrations of roof to be in accordance with requirements of Division 7 - Thermal and Moisture Protection.
  - 4. Based on Thunderline Corp. Link Seal Wall Sleeve or approved equal..
- D. Pipe Seals: Composition Plastic Pressure Plates, zinc coated bolts, nuts and metal parts, composition rubber sealing element designed for long term stability rated for temperatures of 40°F to +250°F. Based on Thunderline Corp. Link Seal LS Series or approved equal.
- E. Duct Hangers and Supports: Fabrication and application of duct hangers and supports shall be in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, Latest Edition, as applicable.
- F. Duct Sleeves: Sleeves shall be provided for ducts penetrating concrete and masonry walls, stud framed fire rated walls, and poured- in-place concrete floors and roofs. Sleeves shall be sized to accommodate duct, insulation and firestopping. Refer to Division 7 for firestopping requirements.
- G. Fabricated Steel Supports:
- 1. Field or shop fabricated. See details on drawings.
  - 2. If not detailed on drawings the contractor is to provide suitable supports as required.

### PART 3 - EXECUTION

#### 3.1 GENERAL REQUIREMENTS

- A. Where applicable install in accordance with the manufacturers written installation instructions.
- B. Where supports are in contact with copper pipe provide copper plated support, or wrap pipe with sheet lead.

- C. Where supports are in contact with glass, aluminum or brass pipe provide plastic coating on supports, or wrap pipe with sheet plastic.
- D. General interior supports, including attachments and pipe supports that are plain steel shall be cleaned of all rust, primed and painted black within one week of installation. At substantial completion all supports shall be free of rust and in a "like new condition".
- E. Hangers and supports, including attachments & pipe supports, exposed to weather or located in utility tunnels or accessible utility trenches or subject to spillage shall be hot dip galvanized after fabrication. At substantial completion all supports shall be free of rust and in a "like new condition".
- F. Fabricated steel supports exposed to weather (including pipe supports) or located in utility tunnels and accessible utility trenches or subject to spillage shall be hot dipped galvanized after fabrication, primed and painted black within one week of installation. Cut, welded, drilled, or otherwise damaged surfaces of galvanized coating shall be repaired in accordance with Section 15050. At substantial completion all supports shall be free of rust and in a "like new condition".

### 3.2 INSTALLATION

#### A. Inserts, Shells and Upper Attachments:

- 1. Inserts:
  - a. Contractor shall have inserts at site and dimensioned location drawings ready at the beginning of the involved concrete work.
  - b. Install inserts by securing to concrete forms and inserting reinforcing rod thru the opening provided in the insert in accordance with shop drawings.
  - c. Provide necessary supervision while concrete is being poured to correct any misalignment caused by the concrete.
- 2. Shells: Size shell length to assure a minimum of 1" solid concrete remaining from shell end to concrete face.
- 3. Upper Attachment:
  - a. Select proper attachment for building construction.
  - b. For plain steel devices, prime with black paint prior to installation.
  - c. Adjust attachment location for proper alignment and no more than 4 deg. offset from a perpendicular alignment.
  - d. If proper alignment cannot be achieved from the existing building structure provide a trapeze type support size to handle the design load with a minimum safety factor of 5.

#### B. Pipe Hanger, Rods, Supports and Accessories:

- 1. Select proper hanger for piping systems.
- 2. The location of hangers and supports shall be coordinated with the structural work to ensure that the structural members will support the intended load.
- 3. Provide hex head nut on rod at top and bottom of clevis hanger yoke, and at each rod connection to intermediate and upper attachment. Rod nuts shall be securely locked in place.
- 4. Hanger rods shall be subject to tensile loading only. Where lateral or axial movement is anticipated, use suitable linkage in hanger rod to permit swing.

5. Hangers shall be fabricated to permit adequate adjustment after erection while still supporting the load. Turnbuckles shall be provided where required for vertical adjustment of the piping.
6. Supports for vertical piping shall be located at each floor or at intervals of not more than 15 feet and at intervals of not more than 8 feet from end of risers. Where supports are provided on intermediate floors spaced 15 feet or less between floors, no additional supports are required other than those specified for end of risers.
7. A hanger or support shall be provided adjacent to each piece of equipment to ensure that none of the pipe weight is supported from the equipment.
8. The maximum spacing between pipe supports for straight runs shall be in accordance with the following chart. If any deviation from the table exists within the manufacturers written installation instructions, whichever spacing reflecting the smaller centerline to centerline dimension shall be used.

MAXIMUM HORIZONTAL PIPE HANGER AND SUPPORT  
SPACING TABLE

- a. Steel Pipe (Schedule 40 & 80):  
Up to 1": 7 ft. on center  
1-1/4" and larger: 10 ft. on center
- b. Copper Pipe (Types L, K and M):  
Up to 1" size: 5 ft. on center  
1-1/4" and larger: 7 ft. on center
- c. Ductile Iron and Cast Iron: Two hangers per section length.
- d. Polyvinyl Chloride (PVC):  
Up to 1-1/2": 3 ft. on center  
2" and larger: 4 ft. on center

10. Hanger centerline spacing shall be reduced by 50% in areas of concentrated valves and/or fittings, also no more than a maximum distance of 12 inches from valves, fittings and/or couplings, or 24 inches from a change in direction.
11. Parallel piping may be supported by trapeze hangers consisting of steel angle, channel, or beam suspended by steel rods attached to upper structure. Piping may be supported above, or suspended below, the angle, channel, or beam.
12. Provide protective shields on all cold and dual temperature piping required to be insulated.
13. Provide protective saddles sized to match insulation thickness on all hot piping required to be insulated. Fill void between saddle and pipe with insulation as specified.
14. Provide turnbuckles on all hangers which require leveling or aligning.
15. Provide steel clevis where detailed and/or required.
16. Provide weldless eye nuts on hanger terminations where disassembly or swing may be required. Use in combination with steel clevis.

C. Pipe Sleeves:

1. Secure sleeves to forms for concrete construction. Ensure sleeves are not disengaged or misaligned by concrete placement operations.
2. Provide temporary cap for open end of sleeves to prevent entrance of concrete.
3. Provide temporary internal bracing where required to prevent distortion of sheet metal sleeves by concrete placement operations.
4. Sleeves shall not be installed in structural members, except where indicated or approved.

5. Furnish sleeves to masonry contractor in advance of masonry work. Furnish dimensioned drawings indicating exact location of sleeves.
  6. Each sleeve shall extend through its respective wall, floor, or roof, and shall be cut flush with each surface, except as indicated otherwise.
  7. Sleeves passing through floors in wet areas, such as areas containing plumbing fixtures or floor drains, shall extend a minimum of 4 inches above the finished floor. Sleeves in wet areas shall be enclosed with 4 inch concrete curb.
  8. Unless otherwise indicated, sleeves shall be of a size to provide a minimum of 1/4 inch clearance all around between the pipe and inside of sleeve, or between jacket over insulation and sleeve.
  9. Provide membrane clamping devices on sleeves for waterproof floors.
  10. Sleeves are not required in existing structures where openings through existing concrete floors, walls, or roof are core drilled.
- D. Pipe Seals:
1. Provide pipe seals for all pipe sleeves used in:
    - a. External walls.
    - b. Floor slabs on grade.
    - c. Upper floors where spillage may occur.
- E. Duct Hanger and Supports: Installation of duct hangers and supports shall be in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, Latest Edition, as applicable.
- F. Duct Sleeves:
1. Secure sleeves to forms for concrete construction. Ensure sleeves are not disengaged or misaligned by concrete placement operations.
  2. Provide temporary cap for open end of sleeves to prevent entrance of concrete.
  3. Provide temporary internal bracing where required to prevent distortion of sheet metal sleeves by concrete placement operations.
  4. Sleeves shall not be installed in structural members, except where indicated or approved.
  5. Furnish sleeves to masonry contractor in advance of masonry work. Furnish dimensioned drawings indicating exact location of sleeves.
  6. Each sleeve shall extend through its respective wall, floor, or roof, and shall be cut flush with each surface, except as indicated otherwise.
  7. Sleeves passing through floors in wet areas, such as areas containing plumbing fixtures or floor drains, shall extend a minimum of 4 inches above the finished floor. Sleeves in wet areas shall be enclosed with 4 inch concrete curb.
  8. Unless otherwise indicated, sleeves shall be of a size to provide a minimum of 1/4 inch clearance all around between the duct and inside of sleeve, or between jacket over insulation and sleeve.
  9. Provide membrane clamping devices on sleeves for waterproof floors.
  10. Duct sleeves shall be secured to opening and have a flange turned back to wall to cover any irregularities in the opening provided for the sleeve.
- G. Fabricated Steel Supports: Steel for supports shall be saw cut, with sharp edges ground smooth. After fabrication remove all foreign material, including welding slag and spatter, and leave ready for painting or galvanizing, as applicable.

END OF SECTION 15090



**SECTION 15100 - VALVES**

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Provisions of Section 15010, Mechanical General Provisions, shall be made an integral part of this section.

1.2 WORK INCLUDED

- A. Angle valves.
- B. Ball valves.
- C. Drain valve.
- D. Valves for Mechanical Joint Systems.

1.3 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this Section to the extent referenced. The publications are referenced to in the text by the basic designation only.
  - 1. American National Standards Institute (ANSI).
  - 2. American Society for Testing and Materials (ASTM).

1.4 SUBMITTALS

- A. Submit schedule and cut-sheets indicating service, make and model number, pressure class, end type and usage (i.e., balance, shut-off).
- B. Product data shall be included in the operation for maintenance instruction manuals along with installation, operation and maintenance instructions.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Angle Valves:
  - 1. Hammond Valve
  - 2. Nibco, Inc.
  - 3. Milwaukee Valve
  - 4. Stockham
- B. Ball Valves:
  - 1. Apollo
  - 2. Crane Company
  - 3. Hammond Valve
  - 4. Milwaukee Valve.
  - 5. Nibco, Inc.

6. Stockham
7. Victaulic Co. of America.
8. Watts

C. Drain Valves:

1. Apollo.
2. Nibco, Inc.
3. Watts

D. Valves for Mechanical Joint Systems: Where a mechanical joint system is proposed, valves shall be furnished by the system supplier where appropriate and shall be equal to those specified.

2.2 FABRICATION

A. Angle Valves:

1. Potable Water Service:

- a. Size 1/4" thru 3". Bronze body, threaded or sweat connection, screwed bonnet, integral seat, renewable teflon or bronze disc, bronze stem, cast aluminum or malleable iron hand wheel, rising stem, inside screw, 125 lb. SWP-200 WOG (non-shock).
- b. Valves installed in insulated piping to have extended handles to clear insulation.
- c. Based on Nibco T-311-Y or approved equal.

B. Ball Valves:

1. HVAC water, oil and steam service:

- a. Size 1/4" thru 2". Two piece, adapter loaded, full port type with brass body, threaded or sweat connection, stainless steel stem, stainless steel ball, teflon or silicone bronze seat, steel lever handle, indicator stop, 150 lb. 600 WOG.
- b. Size 1/2" thru 2". Two piece, standard port type with brass body, Vic Press 304™ connection, brass ball and stem, Teflon seat, carbon steel handle, 300 CWP. Victaulic Series 589 or approved equal.
- c. Valves installed in insulated piping to have extended handles to clear insulation. Stem extension shall be made of a non-thermal conducting material with a sleeve to form an insulated vapor seal after the valve is insulated. Based on Nibco T-585-70-66 or approved equal.

2. Potable water service:

- a. Size 1/4" thru 2". Brass body, threaded or sweat connection, stainless steel stem, stainless steel or aluminum bronze conventional ported ball, teflon or silicone bronze seat, steel lever handle, indicator stop, 150 lb. 600 WOG.
- b. Size 1/2" thru 2". Two piece, standard port type with brass body, Vic Press 304™ connection, brass ball and stem, Teflon seat, carbon steel handle, 300 CWP. Victaulic Series 589 or approved equal.
- c. Valves installed in insulated piping to have extended handles to clear insulation. Stem extension shall be made of a non-thermal conducting material with a sleeve to form an insulated vapor seal after the valve is insulated. Based on Nibco T-580-70 or approved equal.

3. Compressed Air Service:
  - a. Size 1/4" thru 2". Two piece, adapter loaded, full port type with brass body, threaded or sweat connection, stainless steel stem, stainless steel ball, teflon or silicone bronze seat, steel lever handle, indicator stop, 150 lb. 600 WOG. Based on Nibco T-585-70-66 or approved equal
  - b. Size 1/2" thru 2". Two piece, standard port type with brass body, Vic Press 304™ connection, brass ball and stem, Teflon seat, carbon steel handle, 300 CWP. Based on Victaulic Series 589 or approved equal.
- C. Drain valves:
  1. HVAC water service:
    - a. Size 1/2" and 3/4". Two piece, adapter loaded, single reduced port type with brass body, iron pipe thread inlet or sweat inlet, 3/4" hose thread outlet, brass cap and chain at outlet, stainless steel stem, stainless steel ball, teflon or silicone bronze seat, steel lever handle, indicator stop, 150 lb. 600 WOG.
    - b. Valves installed in insulated piping to have extended handles to clear insulation.
    - c. Based on Watts B-6000-CC or B-6001-CC or Nibco T-585-70HC or approved equal.
  2. Potable water service:
    - a. Size 1/2" and 3/4". Two piece, adapter loaded, single reduced port type with brass body, iron pipe thread inlet or sweat inlet, 3/4" hose thread outlet, brass cap and chain at outlet, stainless steel stem, stainless steel ball, teflon or silicone bronze seat, steel lever handle, indicator stop, 150 lb. 600 WOG.
    - b. Size 1/2" thru 2". Two piece, standard port type with brass body, Vic Press 304™ connection, brass ball and stem, Teflon seat, carbon steel handle, 300 CWP. Based on Victaulic Series 589 or approved equal.
    - c. Valves installed in insulated piping to have extended handles to clear insulation. Based on Watts B-6000-CC or B-6001-CC or Nibco T-585-70HC or approved equal.
- D. Valves for Mechanical Joint Systems: Valves shall be constructed as described above for the type used.

### PART 3 - EXECUTION

#### 3.1 GENERAL

- A. Provide shut-off valves on the inlet and outlet of each piece of equipment at the take-off of each major branch from a header and at the base of each pipe riser in order to facilitate service.
- B. Provide drain valves at the base of each pipe riser and at each piece of equipment to facilitate service.
- C. Provide locking device on handle of the expansion tank isolation valve to prevent accidental closing.

3.2 INSTALLATION

A. Angle Valves:

1. Install valve in the upright or horizontal position.
2. Back disc off from seat prior to heating for sweat connected valves.
3. Provide a minimum of the manufacturers recommended clearance for stem travel and disc replacement.
4. Install valve with pressure under the disc.

B. Ball Valves:

1. Install valves with adequate access to lever actuator.
2. Provide adequate space for actuator handle in the open and closed position and for packing replacement.
3. Provide infinite position handle with memory stop on the outlet of all heat exchangers for balancing purposes.

C. Drain Valves: Install valves to provide adequate space for hand wheel, access, stem travel, disc replacement cap removal and clearance for easy hose connection without crimping hose.

D. Valves for Mechanical Joint Systems: Valves shall be installed as described above for the type used.

END OF SECTION 15100

## SECTION 15133 - REFRIGERATION PIPING AND SPECIALTIES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 WORK INCLUDED

- A. Refrigerant (RS/RL/RHG) Piping.
- B. Valves and Specialties

#### 1.3 DEFINITIONS

- A. The pipe sizes given in this document shall be construed as nominal pipe sizes.

#### 1.4 QUALITY ASSURANCE

- A. All material provided under this section shall be standard catalogued products of recognized manufacturers regularly engaged in the production of such products, and shall be of the manufacturer's most recent design that is in regular production.
- B. Each item provided under this section shall meet the requirements for that item as installed and used, in accordance with the following standards:
  - 1. Metallic Piping Systems employing mechanical joints and grooved-end pipe - ASME/ANSI B-31.9
  - 2. Refrigeration Piping and Heat Transfer Components - ASME/ANSI B31.5
  - 3. Safety Code for Refrigeration Systems – ASHRAE 15
  - 4. Refrigerant Containing Components and Accessories – UL 207
- C. Each piping system shall be in accordance with the system design pressures shown in paragraph 2.1 - Materials, this specification section.
- D. All materials provided under this section shall be new, except where the specifications and/or drawings permit the reuse of certain existing materials.

#### 1.5 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this Section to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. The work and materials listed in this Section shall be provided in accordance with the standards and requirements set forth in the applicable portions of the latest editions of the referenced publications.
  - 1. American National Standards Institute (ANSI) Standards
  - 2. American Petroleum Institute (API) Specification
  - 3. American Society of Mechanical Engineers (ASME) Publications
  - 4. American Society for Testing and Materials (ASTM) Publications
  - 5. American Welding Society (AWS) Publication
  - 6. American Water Works Association (AWWA) Standards

8. The Manufacturer's Standardization Society of the Valve and Fittings Industry (MSS) Publications
9. National Fire Protection Association (NFPA) Standards
10. National Sanitation Foundation (NSF) Testing Laboratory Standards.
11. Plastic Pipe Institute (PPI) Manual.
12. Underwriters Laboratories (UL)

## 1.6 SUBMITTALS

- A. Materials List: Submit a list identifying the specific type of material that will be used for each piping system. Include pipe, pipe fittings, valves and joints. Include the basic designation of the publication applicable for each type of material and method.
- B. Refrigeration Piping Requirements: Submit a letter from the refrigeration equipment manufacturer stating that the refrigeration piping system, as shown on the contract documents, is acceptable for the equipment the manufacturer proposes to furnish, or submit drawings prepared by an authorized representative of the refrigeration equipment manufacturer.

## PART 2 – PRODUCTS

### 2.1 MATERIALS

- A. Refrigerant (RS/RL/RHG) Piping.  
System Design Pressure: 300 psig.
  1. Piping carrying Refrigerants shall be either ACR copper, or carbon steel.
  2. ACR Copper Refrigerant Piping:
    - a. Piping, 3" and smaller: Type ACR hard-drawn copper tubing, ASTM B88, ANSI H23.1.
    - b. Fittings, 3" and smaller, all types, wrought copper: ASTM B16.22, ANSI B16.22. All 90° elbows shall be the long radius type.
    - c. Brazing: Contractors Option:
      - (1) 5% silver, 6% phosphorus, balance copper, 1190°F melting point. AWS A5.8 number BCuP -3. J.W. Harris Stay-Silv® 5 or equal.
      - (2) 15% silver, 5% phosphorus, balance copper, 1190°F melting point. AWS 5.8 number BCuP-5. J.W. Harris Stay-Silv® 15 or equal.
      - (3) 6% silver, 6.1% phosphorus, balance copper, 1190°F melting point. QQ-B-654A number BCuP -5. J.W. Harris Dynaflo® 5 or equal
    - d. Unions used shall be specifically designed for refrigeration piping.

### 2.2 VALVES AND SPECIALTIES

- A. Filter Drier:
  1. Replaceable core type.
  2. Heavy steel, cadmium plated with external coat of paint.
  3. All internal parts cadmium plated.
  4. Outlet seal gasket with spring to prevent bypassing.

5. Copper fittings brazed to steel shell, suitable for soldering with Sil-Fos or Phos-Copper solder.
  6. Molded porous core elements.
  7. Tie rod assembly to permit external assembly with one piece insert.
  8. Bolt and nut attachment.
  9. Size for refrigerant capacity and tonnage at 2 psi pressure drop.
  10. Acceptable Manufacturers: Sporlan, Alco, Hubbell, Phillips, Henry.
- B. Moisture and Liquid Indicators:
1. Suitable for R-410A.
  2. Accurately calibrated to change color for indication of moisture.
  3. Large full view sight glass.
  4. Removable indicator element for sizes 1-3/8" and up. Remove before soldering.
  5. Full line size for liquid lines up to 2-1/8" O.D. 3/8" bypass indicator with preformed installation kit on larger sizes.
  6. Acceptable Manufacturers: Sporlan, Alco, Hubbell, Phillips, Henry.
- C. Sight Glasses:
1. Similar to Sporlan "See-all" moisture and liquid indicator with solder type connections.
  2. Install sight glass of the same size as the liquid line.
- D. Miscellaneous Valves and Accessories:
1. Drain valves for all pressure vessels.
  2. Dual pressure relief valves with manifold for all pressure vessels.
  3. Refrigerant service valves where indicated.
  4. Pressure - Temperature Test Ports and Test Kit:
    - a. Brass or stainless steel body with threaded cap and gasket.
    - b. Two self closing valves with intermediate pocket for added pressure protection.
    - c. Pressure temperature test kits consisting of 0- 100 psi pressure gauge with adapter, 25-125°F testing thermometer, 0-220°F testing thermometer, gauge adopted and protective carrying case (two required).
- E. Locking Refrigerant Caps
1. Precision machined from high grade brass surrounded by a protective aluminum shroud. 3 year warranty. Provide one multi key per project to maintenance personnel.
  2. Acceptable Manufacturers: NOVENT, C&D Valve or approved equal.
- F. Refrigerant Charge: ASHRAE 34, R-410A: Pentafluoroethane/Difluoromethane

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. General:
1. Furnish and install piping, fittings and appurtenances required to complete the piping systems shown on the drawings. Elbows shall be long radius type. Tees

- may not be field fabricated.
2. Run piping to true alignment, generally parallel or perpendicular to building walls, floors and ceilings, and with uniform grades and spacing, so as to present a neat and workmanlike appearance.
  3. Care shall be paid to the exact locations of piping with respect to equipment, ducts, conduits, slabs, beams, lighting fixtures, columns, ceiling suspension systems, etc. to provide maximum access to mechanical and electrical equipment in the building. Close coordination and cooperation shall be exercised with other trades in locating the piping in the best interests of the Owner. The drawings and specifications covering other work to be done in the building shall be carefully studied and arrangements made to avoid conflict.
  4. Not all necessary pipe offsets are indicated on the drawings because of the small scale. The various runs of piping to be installed shall be studied and adjustments made in exact routings as may be required for proper installation.
  5. Conflicts arising during the erection of piping shall be brought to the attention of the Owner's Representative. No improvising or field changes will be permitted without the approval of the Owner's Representative.
  6. Use full lengths of pipe wherever possible. Short lengths of pipe with couplings will not be permitted. Cut to exact measurement and install without forcing or spring unless otherwise shown on the drawings or specified.
  7. Avoid tool marks and unnecessary pipe threads. Burrs formed when cutting pipe shall be removed by reaming. Before installing any pipe, care shall be taken that the inside is thoroughly cleaned and free of cuttings and foreign matter. Measures shall be taken to preserve this cleanliness after erection.
  8. Arrange pipe connections to valves and specialties so that there is clearance for easy removal of the valve or specialty from the line, and also for the removal of the valve bonnet and interior, and the specialty top and bottom and interior, except where otherwise approved by the Owner's Representative.
  9. Erect piping in such a manner so as to obtain sufficient flexibility and to prevent excessive stresses in materials and excessive bending movements at joints or connections to equipment. Make allowances throughout for expansion and contraction of piping. Provide each riser and horizontal run of piping with expansion loops, expansion joints, or expansion compensators where indicated and required. Securely anchor and adequately guide pipe as required or where indicated to force expansion to the expansion device without bending, binding, or misalignment of pipe. Branch connections from mains to risers shall be made with ample swing or offset to avoid undue strain on fittings or short pipe lengths. Where indicated, in lieu of expansion loops, expansion joints, or expansion compensators, horizontal runs of pipe shall be anchored at approximately midway of the run to force expansion, evenly divided, toward the mains and risers to provide for expansion and contraction of piping. Flexibility shall be provided by installing one or more turns in the line so that piping will spring enough to allow for expansion without straining.
  10. Installed piping shall not interfere with the operations or accessibility of doors or windows and shall not encroach on aisles, passageways and equipment, and shall not interfere with the servicing or maintenance of any equipment. Adjacent pipelines shall be grouped in the same horizontal or vertical plane.
  11. Where lines are purposely pitched for drainage, an accurate grade shall be maintained. No lines shall be supported in such a manner as to permit deflection, due to gravity, sufficient to pocket the lines when full of liquid. Grade mains as indicated by arrows on the drawings and in accordance with gradient as indicated in attached Piping Schedule.
  12. Piping found to have water hammer or other objectionable vibrations which cannot be eliminated by proper grading or other natural means, shall be braced, trapped or hung with shock absorbing hangers and equipped with air chambers, mechanical shock absorbers, flexible pipe connections or otherwise silenced



- using approved means.
13. Use building steel wherever possible for supporting pipe hangers. Main structural steel shall not be drilled, cut or burned for hangers without the approval of the Owner's Representative. Expansion bolts shall be used only upon the approval of the Owner's Representative.
  14. Install unions or flanges in piping connections to equipment, regulating valves, and wherever necessary to facilitate the dismantling of piping and/or removal of valves and other items requiring maintenance.
  15. Avoid bushings. Reducing fittings shall be used wherever practical.
  16. The drawings indicate the size of piping and connections, and if certain sizes are omitted or unclear, obtain additional information before proceeding.
  17. The piping drawings have been worked out with a view to the most economical installation, taking into consideration accessibility and appearances, and the Contractor must follow the drawings accurately and if it is found impractical to install the work in accordance with the drawings and specifications, the Contractor shall notify the Owner's Representative before making any changes and get their approval or revised drawings before proceeding with the work. Verify all measurements on the job before cutting pipes or having piping fabricated, and be responsible for the correct location of all pipe connections, also check sizes and standard of outlets on the equipment, including the dimensions and drilling of flanges, etc.
  18. Copper tubing and galvanized steel shall not be mixed in any one run of piping.
  19. Change in direction shall be made with fittings, except that bending of steel and copper pipe 4 inches and smaller will be permitted, provided a pipe bender is used and wide sweep bends are formed. The center-line radius of bends shall be not less than 6 diameters of the pipe. Bent pipe showing kinks, wrinkles, flattening, or other malformations is not acceptable.
  20. Threaded joints shall be made with tapered threads in accordance with ANSI B2.1, and made tight with an approved pipe thread joint compound or material, applied to the male threads only. Use compounds sparingly and apply with caution to ensure that compounds do not enter piping systems. When pipe joint is made up a maximum of 3 threads shall be visible.
  21. Joints for plastic pipe shall be made in accordance with PPI Piping Manual.
  22. Connections between ferrous and nonferrous metallic pipe shall be made with dielectric unions or flanges.
  23. Connections between plastic and metallic pipe, between plastic and glass pipe, and between metallic and glass pipe, shall be made with transition fittings manufactured for the specific purpose.
  24. Unions and flanges shall not be concealed in walls, partitions, or above inaccessible ceilings.

B. Valve and Specialties Applications

1. Install service valves for gage taps at inlet and outlet of hot-gas bypass valves and strainers if they are not an integral part of valves and strainers.
2. Install a check valve at the compressor discharge and a liquid accumulator at the compressor suction connection.
3. Install solenoid valves upstream from each expansion valve and hot-gas bypass valve. Install solenoid valves in horizontal lines with coil at top.
4. Install thermostatic expansion valves as close as possible to distributors on evaporators.
  - a. Install valve so diaphragm case is warmer than bulb.
  - b. Secure bulb to clean, straight, horizontal section of suction line using two bulb straps. Do not mount bulb in a trap or at bottom of the line. Verify proper location for the bulb with the valve manufacturer

- c. If external equalizer lines are required, make connection where it will reflect suction-line pressure at bulb location.
  5. Install safety relief valves where required by ASME Boiler and Pressure Vessel Code. Pipe safety relief-valve discharge line to outside according to ASHRAE 15.
  6. Install moisture/liquid indicators in liquid line at the inlet of the thermostatic expansion valve or at the inlet of the evaporator coil capillary tube on each circuit.
  7. Install strainers upstream from and adjacent to the following unless they are furnished as an integral assembly for device being protected:
    - a. Solenoid valves.
    - b. Thermostatic expansion valves.
    - c. Hot-gas bypass valves.
    - d. Compressor.
  8. Install filter dryers in liquid line between compressor and thermostatic expansion valve on each circuit.
  9. Install receivers sized to accommodate pump-down charge.
  10. Install flexible connectors at compressors.
  11. Locking Refrigerant Caps: Provide at all exterior refrigerant service access ports (Schrader valves).
  12. Provide nickel plated brass escutcheons or floor plates, around pipes piercing floors and walls in finished spaces. Fit around insulation or around pipe if uninsulated. Secure to pipe with setscrew. Provide deep escutcheon where sleeve projects beyond finished surface
- C. Refrigerant Systems Additional Requirements:
  1. Installation shall be in accordance with ANSI B31.5 Refrigeration Piping, unless specified otherwise herein.
  2. Brazing procedures and operators shall be qualified in accordance with the requirements of Section IX of the ASME Boiler and Pressure Vessel Code.
  3. Refrigerant pipeline accessories that may be damaged by heat shall be disassembled prior to joint brazing. Reassemble accessories after joint brazing operations are completed.
  4. Joints shall be made with solder-type fittings. The outside surface of the tube where engaged in the fitting, and the inside surface of the fitting in contact with the tube, shall be cleaned with an abrasive material before brazing. Self-cleaning compounds are not allowed. Care shall be taken to prevent annealing of tube and fittings when making connections. Brazed joints shall be made with flux and the previously specified silver-brazing alloy. The brazing alloy shall be applied and drawn through the full fitting length. Excess brazing alloy shall be wiped from the joint before the brazing alloy hardens. Joints shall be made with heat applied uniformly around the entire circumference of the tube and fittings. Remove all excess flux for a clear visual inspection of all brazed connections.
  5. Refrigerant piping installed below concrete slab- on-grade shall be installed in continuous runs without joints, and shall be encased in PVC plastic conduit. Ends of conduit shall be sealed watertight.

### 3.2 BRAZING AND SOLDERING

- A. Operator and Procedure Qualifications: All brazing operators and all brazing procedures shall be qualified in accordance with the requirements of Section IX of the ASME Boiler and Pressure Vessel Code.

- B. Brazing: Silver braze joints in accordance with MSS-SP-73 "Silver Brazing Joints for Wrought and Cast Solder Joint Fittings".
- C. Soldering:
  - 1. Joints in copper tubing shall be made with solder- type fittings. Outside surface of the tube where engaged in the fitting, and inside surface of the fitting in contact with the tube, shall be cleaned with an abrasive material before soldering. Self-cleaning compounds shall not be used. Care shall be taken to prevent annealing of tube and fittings when making connections. The solder joint shall be made with flux and wire form solder, except brazed joints. The flux shall be a mildly corrosive liquid or a petroleum based paste containing chlorides of zinc and ammonium. Solder shall be applied and drawn through the full fitting length. Excess solder shall be wiped from joint before solder hardens. Joints in copper tube sizes 2-1/2 inches and larger shall be made with heat applied uniformly around the entire circumference of the tube and fittings by a multi-flame torch. Use of oxy-acetylene cutting torch in lieu of multi-flame torch is not permitted. Disassemble valves and other accessories that may be damaged by heat before soldering.

### 3.3 TESTING OF PIPING SYSTEMS:

- A. Each piping system, after erection, shall be subjected to a pressure test. The test requirements shall be as follows:
  - 1. General: Furnish everything required for the tests. Notify Architect/Engineer at least 48 hours before any testing is performed. Independent Agent/Owner shall verify pressure test and sign off. Report to be furnished to Architect/Engineer. Testing shall be performed at the completion of each phase of the project.
  - 3. Refrigerant Piping Systems shall be tested with dry carbon dioxide, or nitrogen, at 315 psig for the high side, and at 245 psig for the low side. If leaks are to be detected by use of an electronic halogen detector, or a halide torch, the system shall be pressurized with refrigerant gas prior to introduction of dry carbon dioxide or nitrogen into the system. Pre-charging of system with refrigerant gas is not necessary for soap bubble leak detection method.
  - 4. Leaks, if any, shall be located, repaired, and retested in accordance with the test method specified for the system in which the leaks are located.
- B. Prior to testing a system, the Contractor shall provide the proper Building Official and the Owner's Representative with not less than 72 hours notice of the proposed test. The Contractor shall obtain approval of the test results. Where written approval is required, the Contractor shall obtain such written approval, and submit a copy of the approval.
- C. Work requiring testing shall not be covered, or otherwise concealed, until testing is completed and approval is granted.
- D. Work, or portions of work, that is altered in any way after testing and approval shall be retested, witnessed, and approval obtained.
- E. Systems requiring hydrostatic tests shall be protected from damage caused by freezing. After tests are completed drain all sections of pipe, including traps, or fill undrained sections and traps with antifreeze solution. Vent all high points to release vacuum and ensure complete drainage of closed systems, and blow out piping with compressed air to remove trapped water.

- F. Duration of tests, unless specified otherwise, shall be the time required to examine each joint in the system being tested.
- G. Systems requiring hydrostatic testing under pressure shall be vented at high points to ensure that all piping is completely filled with the testing medium.
- H. Disconnect pressure boosting apparatus, or vacuum pumps, during the test time span specified for systems employing the pressure loss/time span test method.
- I. During tests, isolate system components that have test pressures less than pressures specified for system tests.
- J. Use clean soapy water applied to exterior of joints to locate leaks in systems using compressed air, dry carbon dioxide, or nitrogen, under positive pressure as a test medium.

END OF SECTION 15133

SECTION 15250 - INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 WORK INCLUDED

- A. Duct Systems Insulation.
- B. Piping Systems Insulation.
- C. Accessories.

1.3 QUALITY ASSURANCE

- A. All products within the conditioned air stream or active plenums shall comply with the NFPA 90A Flame/Smoke rating of 25/50 and comply with UL 181 erosion limitations. Fire hazard ratings shall be as determined by NFPA-255, "Method of Test of Surface Burning Characteristics of Building Materials" - ASTM E84 or UL 723.
- B. All adhesives, cements, finishes, jackets, etc., shall be UL listed or labeled for use as applied to insulation and designed specifically for use in the installation.
- C. All insulation shall be installed in accordance with National Commercial & Industrial Insulation Standards (NCIA).

1.4 SUBMITTALS

- A. Submit schedule indicating type of insulation, thickness, vapor barrier or coating by system and size.
- B. Product data, along with installation operation and maintenance instructions, shall be included in the operation and maintenance manuals.
- C. Submit details of insulated removable covers using the actual equipment dimensions, concrete base sizes and piping arrangements.

1.5 GENERAL REQUIREMENTS

- A. Factory-applied insulation is specified under the applicable equipment Section of these specifications. It is listed here for reference only.
- B. Acoustical duct liner is specified under Section 15840 - Shop Fabricated Ductwork. It is listed here for reference only.
- C. Packages and standard containers of materials shall be delivered unopened to job site and shall have the manufacturer's label attached giving a complete description of the material.

1.6 DEFINITIONS

- A. The term "exposed" means exposed to view in finished spaces, in equipment rooms, in fan rooms, in closets, in utility corridors, in tunnels, on roof, in storage rooms, and in other

spaces as indicated.

- B. The term "concealed" means concealed from view, and includes all spaces not defined as exposed.
- C. The term "unconditioned" space shall mean all places where the temperature surrounding the pipe has not been conditioned consistent with conditioned spaces, and shall include mechanical equipment rooms, non-active ceiling plenums, and non-accessible chases. This term shall also include conditioned spaces where the humidity levels are allowed to rise above 70% RH.

## PART 2 - PRODUCTS

### 2.1 ACCEPTABLE MANUFACTURERS

- A. Fiberglass Insulation:
  - 1. Owens-Corning Fiberglas
  - 2. Knauf Fiberglass
  - 3. CertainTeed
  - 4. Johns Manville
- B. Closed Cell Elastomeric Insulation:
  - 1. Armacell LLC
  - 2. Johns Manville
  - 3. Rubatex
- C. Jackets:
  - 1. Southern Asbestos Company
  - 2. John Mansville
  - 3. Owens-Corning Fiberglas
- D. Insulation Coatings, Mastics, Adhesives, and Sealants
  - 1. Foster
  - 2. Childers
  - 3. Pittsburgh Corning
  - 4. Armacell

### 2.2 INSULATION REQUIREMENTS

- A. Refer to the drawings for insulation requirements.

### 2.3 MATERIALS

- A. Duct Insulation:
  - 1. Rigid Fiberglass: Resin bonded fibrous glass, flame retardant, factory applied all service jacket (ASJ) vapor barrier, maximum vapor permeance of .02 perm/in and puncture resistance of 50 units, minimum density 3.0 lb/cf, maximum conductivity per 1" thickness of .23 at 75°F mean temperature. Based on Knauf Insulation Board or approved equal.
  - 2. Blanket Fiberglass: Flexible fibrous glass, flame retardant factory laminated foil-skrim-kraft (FSK) vapor barrier, 2" stapling flange, maximum vapor permeance

of .02 perm/in., minimum density of 1.5 lb/cf, maximum conductivity per 1" thickness of .28 at 75°F mean temperature. Based on Knauf Duct Wrap or approved equal.

B. Pipe Insulation (to 450F):

1. Rigid Fiberglass: Resin bonded fibrous glass, flame retardant, factory applied all service jacket vapor barrier with self sealing pressure sensitive lap joints, molded to accommodate pipe, maximum vapor permeance of .02 perm/in. and a puncture resistance of 50 units, minimum density 4.0 lb/cf, maximum conductivity per 1" thickness of .23 at 75°F, .29 at 200°F and .43 at 400°F mean temperature. Based on Knauf Pipe Insulation or approved equal.
2. Closed Cell Elastomeric (Small Pipe Sizes up to 5 Inches): Flexible, elastomeric, closed cellular, tubular molded to accommodate piping, smooth outer surface suitable for painting with vinyl lacquer type coating, water resistant, non absorbent, ozone resistant, minimum density of 4 lb/cf, maximum conductivity per 1" thickness of .27 at 75°F mean temperature. Based on Armacell LLC AP Armaflex and Self-seal Armaflex 2000 or approved equal.

C. Accessories:

1. PVC pipe jacket and fitting covers used with insulation for pipe, elbows, tees, couplings, 25/50 flame/smoke ratings, suitable for temperatures to 500°F.
2. Glass Cloth Pipe, Duct and Equipment Jacket: Glass lagging cloth, 8 oz/sy treated weight. Secure with elastomeric insulating adhesive on elastomeric insulation, for fiberglass insulation use appropriate mastic finish as recommended by the insulation manufacturer with the perm rating of the mastic equal to or less than that of the insulation it is sealing.
3. Corner angles shall be minimum 28 gauge, 1 inch by 1 inch aluminum adhered to 2 inch by 2 inch heavy kraft paper.
4. Glass tape shall be a minimum density of 1.6 ounces per square yard, 4 inch wide with a 10 x 10 thread count per inch of width. Glass cloth shall be untreated.
5. Staples shall be outward clinching type, Type 304 or 316 stainless steel in accordance with ASTM A 167 or Monel® coated.
6. Wire shall be soft annealed galvanized, or copper, 16 gauge, or nickel copper alloy.
7. Closed cell elastomeric insulated finish shall be a white water based flexible, acrylic latex enamel equal to WB Armaflex finish or approved equal.
8. Insulation Tape: Closed cell elastomeric insulation: 2" wide x 1/8" thick.
9. Elastomeric Insulation Adhesive: Air drying contact adhesive for securing sheets to flat or curved metal surfaces and joining seams and butt joints of elastomeric insulation. Suitable for temperatures to 180F, dried film not to exceed 25 for flame spread and 50 for smoke development when tested per ASTM E 84-84A method.
10. Vapor Barrier Mastic: Air drying flexible water based mastic used for applying a vapor barrier joint with glass cloth at insulation joints. Suitable for temperatures to 180°F, wet and dried film not to exceed 25 for flame spread and 50 for smoke development when tested per ASTM E 84-84A method. Maximum Perm rating of 0.08. , Childers Products Company, Inc. CP-35 Chil Therm® WB, Foster Products Corp. Product Data 30-80 Foster Vapor Safe® Coating, Marathon Industries, Inc. 590 LO-PERM, Richard's Paint Manufacturing CO., Inc. VBM-4, Vimasco Corp. 749 Vapor-Blok, or equal.
11. Acrylic Latex Finish and Sealers:
  - a. Elastomeric Insulations: Air drying flexible water based finish used for finishing flexible elastomeric insulation. Suitable for temperatures to 180°F, wet and dried film not to exceed 25 for flame spread and 50 for smoke development when tested per ASTM E 84-84A method. Armacell

LLC WB Armaflex finish or approved equal.

### PART 3 - EXECUTION

#### 3.1 GENERAL REQUIREMENTS

- A. Install all insulation in strict accordance with the manufacturers written installation instructions.
- B. All insulation work shall be performed by skilled mechanics regularly engaged in the insulation trade.
- C. Properly coordinate the insulation work with the other trades so that installation is performed with a minimum of conflict.
- D. Insulation shall not be applied on any piping or duct system requiring testing until testing is completed and approved by Owner's Representative.
- E. Insulation shall not be applied until all systems are clean, dry, free of dirt, dust or grease.
- F. The finished installation shall present a neat and acceptable appearance which includes but is not limited to: all jackets smooth, all vapor barriers sealed properly, no evidence of "ballooning" of the jackets, or sagging insulation, all valves, dampers, gauges, unions, etc. accessible. The Owner's Representative shall be the final judge of acceptance of workmanship.
- G. All equipment nameplates on hot equipment shall be left uncovered. All equipment nameplates on cold equipment shall have a removable section sized to expose the nameplate. This section shall be clearly marked "NAMEPLATE".
- H. If proper maintenance procedures require access to the insulated equipment removable panels, sections or covers shall be provided to accomplish this. These access devices shall be constructed in a manner to assure easy access and sturdy construction. The contractor shall assume the responsibility to coordinate all equipment requiring insulation to be either factory or field insulated.
- I. Insulation and accessories shall be applied only at suitable application temperature and conditions as recommended by the manufacturer. Do not apply insulation to any surface while it is wet.
- J. Insulation shall be protected from moisture and weather during storage and installation.
- K. Insulation which has sustained moisture damage, torn jackets, or other damage due to improper storage or other reasons shall not be used. If evidence of this is sighted the Owner's representative reserves the right to require the insulating contractor to remove any and/or all insulation until the Owner's Representative is satisfied that there is no longer any inferior insulation installed on this project.
- L. Insulation, fabric and jacketing shall be protected from damage during construction. Damage by the insulator shall be repaired without cost to the Owner. Damage by others shall be reported in writing to the contractor.
- M. The insulation subcontractor is responsible for proper material storage at the work site.
- N. Work performed prior to receipt of approved documents or submittals, later proving to be incorrect or inappropriate, shall be promptly replaced by the contractor without cost to the



purchaser.

- O. Insulation shall not be installed until adequate access and clearances at control mechanisms, dampers, sleeves, columns and walls have been provided.
- P. All insulation at handholes, access doors or other openings, and adjacent to flanges and valves shall be neatly finished where exposed to view.
- Q. Where an insulated pipe or ductwork passes through a sleeve or opening in a non-rated partition, the full specified thickness of the insulation shall pass through the sleeve or opening. Where an insulated pipe or ductwork passes through a rated partition, the insulation shall be stopped at the partition. The void between the pipe and the sleeve shall be sealed with an approved fire-stopping material, and the insulation trimmed and sealed to the partition sufficient to cover the sleeve.
- R. All materials, accessories and methods of installation and fabrication are subject to the Owner's Representatives inspection and approval during any phase of the work.
- S. The insulation subcontractor shall prevent the accumulation of insulation debris in the buildings and on the premises of the Owner.
- T. The insulation subcontractor shall be responsible for his own safety program at the work site, and shall provide instruction on safe practices for his workers assigned to the project. All employees are subject to the work rules at the job site.
- U. The insulation subcontractor shall familiarize himself with the progress and execution of the job and notify the proper parties of interferences and any problems with the proper installation of his materials.

### 3.2 INSTALLATION

#### A. Duct Insulation:

##### 1. General:

- a. Insulate or internally line all flexible duct connectors equal to or greater than adjacent insulation thickness.
- b. The tops of all diffusers shall be insulated same as connecting ductwork to prevent condensation.
- c. Duct insulation at fire dampers shall be extended over supporting angle iron and sealed to wall.

##### 2. Rigid Fiberglass Insulation:

- a. Use boards in largest possible size to minimize seams. Do not use "scraps".
- b. Provide corner angles where insulation is subject to harm.
- c. All fasteners shall be non corroding.
- d. The insulation shall be applied by use of cup head weld pins. Such fasteners shall be spaced in accordance with NCIA recommendations, where NCIA standards do not address exact dimensions, cup head weld pins shall be spaced on 12" centers. Pin caps shall be covered with a round vapor seal patch that matches the jacket on the ASJ board. On cold ducts, these shall be coated so as to not cause condensation.
- e. Ducts having sharp bends shall have the insulation scored as required to conform to the curved surfaces to provide a neat and acceptable

- appearance when finished.
- f. Insulation edges and joints shall be finished with two coats of an approved vapor barrier mastic, reinforced with glass cloth extending 2 inches onto adjacent insulation. One coat of mastic shall be applied to the insulation prior to the application of the glass cloth, which shall be embedded in the mastic to ensure complete adhesion of the cloth.
  - g. Generally, rigid fiberglass material will only be used in finished or exposed areas, and it is intended that the finish present a neat and uniform appearance as to color and workmanship.
  - h. In finished areas, molded glass fiber insulation shall be used to insulate round ducts where commercially available sizes can be used.
  - i. Fittings on round ducts in finished areas shall be covered with premolded fiberglass fitting insulators equal to Insul-Coustic where sizes are available. For sizes where premolded fittings are not available use miter-cut segments of molded pipe insulation, wired in place, with all joints sealed with adhesive and smoothed out with a coat of insulating cement.
  - j. On cold ducts, the fittings shall be finished with two coats of an approved vapor barrier mastic, reinforced with glass cloth extending 2 inches onto adjacent insulation. One coat of mastic shall be applied to the insulation prior to the application of the glass cloth, which shall be embedded in the mastic to ensure complete adhesion of the cloth. Hot ducts shall be finished in a similar manner, except the mastic need not be of the vapor barrier type.

3. Blanket Fiberglass Insulation:

- a. Insulation shall be tightly wrapped on the ductwork with all circumferential joints butted and longitudinal joints lapped 2 inches and stapled. Joints shall be finished with two coats of an approved vapor barrier mastic, reinforced with glass cloth extending 2 inches onto adjacent insulation. One coat of mastic shall be applied to the insulation prior to the application of the glass cloth, which shall be embedded in the mastic to ensure complete adhesion of the cloth. Additionally secure insulation to bottom of rectangular ducts over 24 inches wide with weld pins at no more than 18 inches on center.
- b. Insulation shall be butted with facing overlapping all joints shall be finished with two coats of an approved vapor barrier mastic, reinforced with glass cloth extending 2 inches onto adjacent insulation. One coat of mastic shall be applied to the insulation prior to the application of the glass cloth, which shall be embedded in the mastic to ensure complete adhesion of the cloth. Breaks, punctures, pin penetrations in facing shall be sealed with vapor barrier tape and vapor barrier adhesive.

B. Pipe Insulation:

1. General:

- a. All locations where the insulated surface is supported by hangers, the insulation shall be protected by shields or saddles properly skimmed to maintain a smooth outer surface, and proper insulation thickness.
- b. All devices connected to or in line with the piping system shall be insulated greater than or equal to the connecting piping. This includes but is not limited to valves, air separators, expansion tanks, control valves, control devices, gauge connections, thermometer stems, chemical feed equipment, piping flexible connectors, etc. This is particularly important on refrigerant lines.

- c. A complete moisture and vapor barrier shall be installed wherever insulation is penetrated by hangers or other projections through insulation and in contact with cold surfaces for which a vapor seal is specified.
  - d. Cover fittings, flanges, unions, valves, anchors, and accessories with premolded or segmented insulation of the same thickness and material as the adjoining pipe insulation. Where nesting size insulation is used overlap pipe insulation 2 inches or one pipe diameter. Fill voids with insulating cement and trowel smooth. Elbows shall have not less than 3 segments per elbow. Secure insulation with wire or tape until finish is applied. Blanket inserts in lieu of premolded or segmented insulation is not allowed. Cover fittings with preformed PVC fitting covers.
  - e. Wrap all pressure gauge taps, thermometer wells and all other penetrations through insulation with closed cell insulation tape so as to prevent condensation.
  - f. Seal all raw edges of insulation.
  - g. For piping supported by hangers outdoors, apply a rainshield to prevent water entry.
2. Rigid Fiberglass:
- a. Provide PVC fitting covers for all fittings.
  - b. Align all jacket seams.
  - c. Assure all vapor barriers are properly sealed.
  - d. Provide PVC jacket over all exposed insulation in the equipment room.
  - e. All corner angles below 6'-10" shall have padded insulation and be marked with yellow stripes.
3. Closed Cell Elastomeric:
- a. All joints shall be sealed with adhesives.
  - b. Where the thickness is to be obtained by use of two layers of insulation, install with staggered joints.
  - c. Finish:
    - 1) Concealed Indoors: No additional finish.
    - 2) Exposed Indoors: Provide PVC jacket over all insulation.
    - 3) Concealed Indoors: Provide PVC jacket over fittings fabricated from insulation sections or sheet.
    - 4) Outdoors: Provide acrylic latex finish.
- D. PVC Jacket:
1. Provide PVC sheet jacket over all exposed, indoor piping or insulation.
  2. Provide PVC pipe jacket over all exposed elastomeric pipe insulation.
  3. Provide PVC fitting covers over all fittings fabricated from insulation sections or sheet material.
  4. PVC pipe jacket shall be applied with special attention given to achieving positive seal at all longitudinal and circumferential joints using a welding solvent on the longitudinal joint as recommended by the manufacturer. Slip joints to have 4" minimum lap and no welding solvent.
- E. Flexible Acrylic Latex:
1. Apply two coats to glass cloth jacket and closed cell elastomeric insulation.
  2. Refer to Division 9 for color to be used. If no instructions are given, provide a white finish.

3.3 MISCELLANEOUS ITEMS

- A. General: Provide insulation of any portion of a system or piece of equipment not previously discussed where ambient operating conditions will allow condensation to occur or whose surface temperature exceeds 115°F. Insulation materials and method shall be as directed by the Designer.
- B. Final Inspection: At final inspection, the finished surfaces of all exposed insulation shall be clean and without stains or blemishes. Repair and clean the insulation surfaces and, if necessary, to obtain a new appearance, shall coat discolored surfaces with off-white latex water-base semi-gloss paint or lagging adhesive, without a change in the contract price.

END OF SECTION 15250

## **SECTION 15400 - PLUMBING SYSTEMS**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Provisions of Section 15010, Mechanical General Provisions, shall be made an integral part of this section.
- C. Provide all the plumbing work in accordance with the Contract Documents.

#### **1.2 RELATED WORK SPECIFIED ELSEWHERE**

- A. Outside utilities 5'-0" beyond the building wall.
- B. Final connections to heating, ventilating and air conditioning equipment.
- C. Cutting and patching.
- D. All concrete foundations or bases.
- E. Mounting of all starters, except those specified to be factory-mounted and wired as part of the equipment. All wiring necessary to supply power to electric motors and remote operating valves, including connections from the disconnect switches and starters to the motors.
- F. Providing the wiring of all plumbing alarm devices excluding house pump controls from the alarm devices to an alarm panel.
- G. Motor disconnect switches and circuit breakers, except in combination starters and where otherwise noted.
- H. All finished painting of exposed pipes and apparatus.
- I. Domestic water meters.
- J. Concrete pits for sump pumping units.
- K. Installation of access doors in finished construction furnished as the work of this Section.
- L. Flashing of floor drains in membrane waterproofed floors.
- M. Excavation and backfilling.
- N. Bracing and supports for hot water heaters.
- O. Toilet accessories.

#### **1.3 WORK INCLUDED**

- A. Plumbing Fixtures and Trim.
- B. Sanitary Waste and Vent Systems.

C. Water Supply System.

1.4 DESCRIPTION OF SYSTEMS

A. Provide all plumbing fixtures and trim as indicated on the drawings and as specified elsewhere herein. All fixtures shall be connected to the plumbing systems as indicated and required for proper operation. Piping materials, accessories, and equipment shall be as specified elsewhere in Division 15.

B. Sanitary Waste and Vent Systems:

1. Provide a complete sanitary, waste and vent system for all fixtures and equipment in the building requiring connections.
2. All waste from the building shall discharge by gravity from the building to 5 ft. outside of building as shown on the drawings.
3. All drains in the Mechanical Room shall be installed with Proset Trap Guards.

C. Water Supply System:

1. Provide a complete water supply system for all fixtures and equipment in the building including domestic water heaters.
2. Local connections to fixtures and equipment shall be not less than full size of the fittings on the fixtures and equipment, and runouts and risers serving same shall be as shown and not less than one pipe size larger than the fittings on the fixtures and equipment.
3. Provide stop-and-waste valves at every branch off water mains where accessible and provide approved gate or compression stops at every connection to fixtures and equipment.
4. Provide shock arresters in accordance with the Plumbing and Drainage Institute Standard PDI-WH201. Provide access door at each location of shock arrester. All shock arresters shall comply with ANSI A112.26.1-1969 (R1975). Coordinate access door locations with the architect.
5. Thermometers shall be provided, on the inlet and outlet of the water heater. Thermometers shall be as specified herein.

1.5 SUBMITTALS:

- A. Submission for acceptance is required.
- B. If applicable, product data, along with installation operation and maintenance instructions, shall be included in the operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 SHOCK ARRESTERS

- A. Shock arrestors shall be barrel-fabricated of type "K" hard drawn copper, piston operated, manufactured by Zurn, Wilkins or Precision Plumbing Products.

2.2 TRAP PRIMERS

- A. Trap primers shall be gray water type to supply by gravity to floor drains.

2.3 BACKFLOW PREVENTERS

- A. 1-1/4" thru 2" reduced pressure zone backflow preventers shall be equal to Watts 909M1QT with 900AG air gap piped to drain.

PART 3 - EXECUTION

3.1 PIPING WORK - INSTALLATION

- A. The drawings shall be followed where they are definite and provided such procedure causes no objectionable conditions or does not conflict with other trades, laws, regulations or recommendations of equipment manufacturers. The drawings are intended to indicate the sizes of piping connections, and if certain sizes are omitted or unclear, obtain additional information before proceeding.

3.2 STERILIZATION OF PIPING AND EQUIPMENT

- A. After all domestic cold water and hot water supply and return piping has been flushed free of foreign matter, and within 30 days prior to turning the building over to the Owner, this piping shall be sterilized in accordance with the requirements Specification Section 15480 – Disinfection of Domestic Water Lines.

END OF SECTION 15400

**SECTION 15421 - DRAINS, CLEANOUTS AND ACCESSORIES**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Provisions of Section 15010, Mechanical General Provisions, shall be made an integral part of this section.

**1.2 WORK INCLUDED**

- A. Floor Drains.
- B. Hub Drains.
- C. Backwater Valves.
- D. Trap Guard
- E. Cleanouts

**1.3 SUBMITTALS**

- A. Each drain submittal must be marked to show what area it will be used.

**1.4 JOB CONDITIONS**

- A. Provide protection for all drains and cleanouts against damage during construction. The plumbing contractor shall be responsible to replace any damaged drains and cleanouts.

**PART 2 - PRODUCTS**

**2.1 ACCEPTABLE MANUFACTURERS**

- A. Refer to the drawings for acceptable manufacturers. Equipment by other manufacturers will be considered provided all requirements and intent of the specifications are met.

**2.2 MATERIALS**

- A. Refer to the drawings for drain and cleanout selections.

**PART 3 - EXECUTION**

**3.1 INSTALLATION**

- A. Drains:
  - 1. Unless otherwise specified, drains to be complete with strainers, trim, flashing and appurtenances and constructed of cast iron with painted finish.
  - 2. Set all floor drains level and at proper elevations to surrounding floor area to provide smooth and uniform drainage area.
  - 3. Unless noted otherwise, provide a trap for each floor drain of a material to match the pipeline to which it discharges.



4. Provide drains in all locations shown on the Architectural and Plumbing drawings. Drains to be of the types specified herein and sized as shown on the plumbing drawings. Refer to the Architectural drawings for additional installation details.
  5. Actual sizes and quantities of all drains shall be determined from the drawings.
  6. Floor drains receiving discharge from relief valves, intermittent solids separators or strainer blow-downs and cooling tower overflow shall be provided with funnel adaptor.
  7. Blow-down from a solids separator on a condenser water system tied into the condenser water treatment system shall have a dedicated funnel drain.
  8. All drains in the Mechanical Room shall be installed with Proset Trap Guards.
- B. Cleanouts:
1. Provide cleanouts in all locations shown on the drawings and in all other locations required by The Local Building Code, and as directed by the Local Inspector.
  2. Where special conditions exist, such as the need for a shallow cleanout to meet invert elevations, make changes necessary at no change in contract price and submit drawings or description for approval if requested by the Architect.
  3. Cleanouts shall be the same size as the pipes they serve up to 4 inch, and not less than 4 inch for piping of larger size.
  4. Cleanouts shall be installed not more than 100 feet apart in horizontal drainage piping.
  5. Cleanouts shall be installed in the horizontal piping at each change of direction of the building waste, soil and storm systems, which is greater than 45 degrees.
  6. A cleanout shall be installed at or near the base of each waste, soil or rain-leader stack.
  7. All work this section shall conform to local building/plumbing code.

END OF SECTION 15421

## **SECTION 15424 - DOMESTIC WATER HEATERS**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Provisions of Section 15010, Mechanical General Provisions, shall be made an integral part of this section.

#### **1.2 RELATED WORK**

- A. All wiring necessary to supply power including connections from disconnect switches.
- B. Concrete Bases.

#### **1.3 WORK INCLUDED**

- A. Provide a complete domestic hot water heating system as shown on the drawings and specified herein, including water heater and accessories.

#### **1.4 QUALITY ASSURANCE**

- A. All components shall be UL listed or labeled.

#### **1.5 SUBMITTALS**

- A. Submit manufacturers certified drawings for all equipment indicating dimensional data, operation and performance data, pump curves, wiring diagrams and installation instructions.

### **PART 2 - PRODUCTS**

#### **2.1 ACCEPTABLE MANUFACTURERS**

- A. Refer to the drawings for acceptable manufacturers. Equipment by other manufacturers will be considered provided all requirements and intent of the specifications are met.

#### **2.2 MATERIALS**

- A. Refer to the drawings for domestic water heater selections.

### **PART 3 - EXECUTION**

#### **3.1 INSTALLATION**

- A. Install in accordance with the manufacturer's written installation instructions.
- B. Do not allow the heater to be started without a full tank of water.

END OF SECTION 15424

**SECTION 15450 - PLUMBING FIXTURES AND TRIM**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Provisions of Section 15010, Mechanical General Provisions, shall be made an integral part of this section.

**1.2 WORK INCLUDED**

- A. The work of this section shall include furnishing all labor and material for complete installation of all plumbing fixtures with fittings, trim, supports and appurtenances as specified herein and shown on the drawings.

**1.3 SUBMITTALS**

- A. Submit shop drawings in accordance with Division 1 requirements.

**PART 2 - PRODUCTS**

**2.1 ACCEPTABLE MANUFACTURERS**

- A. Refer to the drawings for acceptable manufacturers. Equipment by other manufacturers will be considered provided all requirements and intent of the specifications are met.

**2.2 EQUIPMENT**

- A. Refer to the drawings for plumbing fixtures selections.

**PART 3 - EXECUTION**

**3.1 FIXTURES**

- A. All plumbing fixtures and trim shall be new as manufactured by firms regularly engaged in the manufacture of plumbing fixtures and trim of type, style and configuration required, whose products have been in satisfactory use and similar service.
- B. Provide protection of all fixtures during construction from damage. Replace all damaged fixtures as directed by the Architect.
- C. Each water supply connection to each fixture and each item of water consuming equipment shall be equipped with an accessible stop valve.
- D. All flush valves shall be diaphragm or piston type with integral screwdriver stops, vacuum breakers and have non-hold-open water saving feature.
- E. All wall-hung fixtures shall be supported on carriers designed and fitted to suit the fixture and building construction at each point of application.
- F. All exposed bolt heads on water closets and urinals shall be covered with acorns or covers made from china, stainless steel, or chrome plated brass.

- G. All plumbing fixtures and equipment shall be provided with all necessary stops, valves, traps, supplies and appurtenances required, except where specifically provided for by another contract.
- H. All handicapped fixtures indicated and shown on the Plumbing and Architectural drawings shall comply with ANSI A117.1-1997.
- I. Insulate hot and cold water supply pipes and waste pipe under lavatory per handicapped codes.
- J. Caulk all gaps between walls/floors and plumbing fixtures.

END OF SECTION 15450

**SECTION 15480 - DISINFECTION OF DOMESTIC WATER LINES**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Provisions of Section 15010, Mechanical General Provisions shall be made an integral part of this Section.

**1.2 WORK INCLUDED**

- A. Provide personnel, equipment and supplies, disinfect domestic hot and cold water systems, and flush out systems at completion of treatment.

**1.3 DEFINITIONS**

- A. Disinfectant Residual means the quantity of disinfectant in treated water.
- B. pH Factor means the measure of alkalinity and acidity in water.
- C. ppm means parts per million.

**1.4 APPLICABLE PUBLICATIONS**

- A. The publications listed below form a part of this Section to the extent referenced.
  - 1. American Waterworks Association (AWWA) Standards.
  - 2. Standard Methods for the Examination of Water & Waste Water (14th edition).

**1.5 QUALITY ASSURANCE**

- A. Water Treatment Contractor: At least five (5) years experience performing work specified herein.
- B. Bacteriological Laboratory: State certification.

**1.6 SUBMITTALS**

- A. Water Treatment Contractor's evidence of experience: Submit three (3) copies.
- B. Bacteriological Laboratory's evidence of certification: Submit three (3) copies.
- C. Test Reports: Submit four (4) copies as follows:
  - 1. Disinfection Report, include:
    - a. Date issued.
    - b. Project name and location.
    - c. Treatment Contractor's name, address, and phone number.
    - d. Type and form of Disinfectant used.
    - e. Time and date of Disinfectant injection start.
    - f. Time and date of Disinfectant injection completion.
    - g. Test locations.

- h. Initial and 24 hour Disinfectant Residuals in ppm for each outlet tested.
- i. Time and date of flushing start.
- j. Time and date of flushing completion.
- k. Disinfectant Residual after flushing in ppm for each outlet tested.

2. Bacteriological Report. Include:

- a. Date issued.
- b. Project name and location.
- c. Laboratory's name, certification number, address, and phone number.
- d. Time and date of water sample collection.
- e. Name of person collecting samples.
- f. Test locations.
- g. Time and date of laboratory test start.
- h. Coliform bacteria test results for each outlet tested.
- i. Certification that water conforms or fails to conform to bacterial standards or fails to conform to bacterial standards of Federal Safe Drinking Water Act.
- j. Bacteriologist's signature.

1.7 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Protect against damage and contamination.
- B. Maintain caution labels on hazardous materials.
- C. Maintain storage room dry and with temperatures as uniform as possible between 60°F and 80°F.
- D. Do not store Caustic Soda directly on floor colder than 55°F.

1.8 PROTECTION

- A. Provide necessary signs, barricades, and notices to prevent any person from accidentally consuming water or disturbing system being treated.

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT

- A. Materials and equipment shall conform to the respective publications and other requirements specified herein.
- B. Disinfectant: Free chlorine; liquid, powder, tablet, or gas.
- C. Alkali: Caustic Soda or Soda Ash.
- D. Acid: Hydrochloric (Muriatic) type.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Prior to starting work verify that domestic water system is completed and cleaned.
- B. Notify Contractor about defects requiring correction.

- C. Do not start work until conditions are satisfactory.

### 3.2 PREPARATION OF WATER FOR TREATMENT

- A. Verify pH factor of water to be treated.
- B. If pH factor is less than 7.2, introduce sufficient Alkali during Disinfectant injection.
- C. If pH factor is greater than 7.6, introduce sufficient Acid during Disinfectant injection.

### 3.3 SYSTEM TREATMENT

- A. Injection Disinfectant throughout system to obtain 50 to 80 ppm residual.
- B. Starting at outlet closest to water source, bleed water from each outlet until water produces odor of Disinfectant. Repeat process at each outlet throughout system. If odorless Disinfectant is used testing is required to determine if Disinfectant is fully dispersed throughout system.
- C. Test for Disinfectant Residual at each of the following locations:
  - 1. Ends of piping runs.
  - 2. Remote outlets.
  - 3. At least 15% of outlets on each floor where directed by Architect, but in no case less than 2 outlets.
- D. Maintain Disinfectant in system for 24 hours.
- E. If Disinfectant Residual is less than 25 ppm, repeat system treatment.

### 3.4 FLUSHING

- A. Remove Disinfectant from system; permit no more than residual rate of incoming water or 1.0 ppm, whichever is greater.

### 3.5 BACTERIOLOGICAL TEST

- A. Instruct Bacteriological Laboratory to take water samples no sooner than 24 hours after flushing system.
- B. Take water samples at each of the following locations:
  - 1. Where water enters system.
  - 2. Ends of piping runs.
  - 3. Remote outlets.
  - 4. At least 10% of outlets on each floor other than those used for testing Disinfectant Residual, where directed by Architect, but in no case less than 2 outlets.
- C. Analyze water samples in accordance with AWWA Standard Methods for the Examination of Water & Waste Water, 14th edition.
- D. If bacteriological test proves water quality to be unacceptable, repeat system treatment until water quality is acceptable.

END OF SECTION 15480

## SECTION 15605 - FUEL STORAGE TANK AND ACCESSORIES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Provisions of Section 15010, Mechanical General Provisions, shall be made an integral part of this section.

#### 1.2 WORK INCLUDED

- A. Double Wall Fiberglass Underground Fuel Storage Tank (UST).
- B. Hydrostatic Tank Leak Detection System with Remote Electronic Panel.
- F. Inventory Control and Leak Detection System for Fiberglass Tank System.
- G. Liquid Level Indicator.
- H. Vent Cap.
- I. Fill or Sounding Line Cap.
- J. Fuel Oil Pump.
- K. Manhole and Cover.
- L. Fuel Filter.
- M. Dual or Single Slip Tank Fitting.
- N. Overflow Prevention Valve.
- O. Piping Requirements.

#### 1.3 QUALITY ASSURANCE

- A. General:
  - 1. NFPA 30 - Flammable Combustible Liquid Code.
  - 2. NFPA 30A – Automotive and Marine Service Station Code
  - 3. NFPA 31 - Standard for the Installation of Oil Burning Equipment, for oil piping materials and components, oil piping installations, and inspection, and testing of fuel oil piping systems.
  - 4. Standard Mechanical Code, 2010 Edition.
  - 5. UL 343 - "Standard for Pumps for Oil Burning Appliances", for oil transfer pumps.
  - 6. UL 567 - "Pipe Connections for Flammable and Combustible Liquids and LP-Gas".
  - 7. General Services Administration, Public Building Service Guide Specification, PBS: 1568.
  - 8. ANSI B31.4 - Liquid Petroleum Transportation Piping System.
  - 9. All equipment and installation shall conform to FDEP regulations Chapter 62-761.
  - 10. All equipment shall be on the FDEP approved list.



- B. Double Wall Fiberglass Underground Storage Tank and Piping:
  - 1. American Petroleum Institute Publication 1615 Installation of Underground Petroleum Storage System.
  - 2. ASTM Specification D4021-810, Standard Specification for Glass Fiber Reinforced Polyester Underground Petroleum Storage Tanks.
  - 3. ASTM D 6751, Standard Specification for Biodiesel Fuel Stock (B100) for Middle Distillate Fuels
  - 3. Factory Mutual File OFGA8.AF.
  - 5. UL 971, UL Listed non-metal pipe.

#### 1.4 SUBMITTALS

- A. Product data for the following products:
  - 1. Fuel storage tank, tank fittings and accessories.
  - 2. Inventory control and monitoring system.
  - 3. Oil transfer pumps. Include performance curves, electrical characteristics, and specified accessories.
  - 4. Oil piping specialties.
- B. Shop drawings detailing fabrication and installation of fuel storage tanks and accessories. Detail equipment assemblies and indicating dimensions, weights, loadings, required clearances, method of field assembly, components and location and size of each field connection.
- C. Wiring diagrams detailing wiring for power and control systems; differentiating between manufacturer-installed wiring and field-installed wiring.
- D. Maintenance data for oil transfer equipment, for inclusion in Operating and Maintenance Manual specified in Division 1.

#### 1.5 CATHODIC PROTECTION INSPECTIONS

- A. Upon completion of installation and prior to obtaining a certificate of use, the contractor shall test the cathodic protection system for adequacy in accordance with the National Association of Corrosion Engineers Standard RP-02-85. "Control of external corrosion on metallic buried, partially buried or submerged liquid storage systems".

#### 1.6 FEDERAL DEMONSTRATION OF FINANCIAL RESPONSIBILITY

- A. Supplier of the UST shall provide evidence of financial responsibility in accordance with State and Federal requirements.

#### 1.7 WARRANTY

- A. Submit written warranty for the underground fiberglass fuel oil storage tank, executed by the manufacturer, agreeing, at the manufacturer's option, to repair the failure, replace the failed tank limited to delivery of new tank to the site of original installation, or refund the original purchase price of the tank, provided the tanks are installed in accordance with the manufacturer's instructions. Warranty shall protect the Owner for a period of 30 years from the date of original purchase, against structural failures of the tank, including cracking, break-up, or collapse; and failure of the tank due to external corrosion and internal corrosion when the tank is used for storage of fuel oils at temperatures not exceeding 150F. This warranty shall be in addition to, and not a limitation of, other rights

against the contractor under the contract documents.

1.8 NOTIFICATION

- A. The mechanical subcontractor, on behalf of the Owner, shall obtain a permit, the required inspections and certificate of use in accordance with the provisions of the local code prior to beginning installation of the UST.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

All products/equipment shall be in listed on the FDEP Approved Equipment list.

- A. Double Wall Fiberglass Underground Fuel Storage Tank:
1. Containment Solutions.
  2. Or approved equal.
- E. Hydrostatic Tank Leak Detection System with Remote Electronic Panel:
1. Veeder Root
  2. Or approved equal.
- F. Inventory Control and Detection System:
1. E.J. Ward
  2. Or approved equal.
- G. Liquid Level Indicator:
1. Veeder Root
  2. Or approved equal
- H. Vent Cap:
1. General Tanks
  2. Or approved equal.
- I. Fill or Sounding Line Cap:
1. OPW
  2. Or approved equal
- J. Fuel Oil Pump:
1. Red Jacket
  2. Or approved equal
- K. Manhole and Cover:
1. OPW, Pomeco Composite.
  2. Or approved equal.
- L. Fuel Filter:
1. General Filter

2. Fuel Flo
  3. Or approved equal.
- M. Dual or Single Slip Tank Fitting:
1. General Tanks
  2. Or approved equal
- N. Overflow Prevention Valve:
1. OPW Fueling Components Division.
  2. Or approved equal.
- O. Fuel Oil Piping Requirements: Piping shall be in accordance with Section 15060, Pipe and Pipe Fittings, and shall include fiberglass underground containment piping and sump manway and manual extension and electronic sensor compatible with the specified electronic control panel.

## 2.2 FABRICATION

- A. Double Wall Fiberglass Underground Fuel Storage Tank:
1. Loading Conditions: Tank shall meet the following conditions:
    - a. External hydrostatic pressure. Buried in ground with 7' of overburden over the top of the tank. The hole fully flooded and a safety factor of 5:1 against general buckling.
    - b. Surface loads: When installed according to manufacturer's installation instructions tanks will withstand surface H-20 axle loads (32,000 lbs./axle).
    - c. Internal load: Primary tank and annular space shall be tested in accordance with manufacturer's specifications.
    - d. Tanks designed to support accessory equipment.
  2. Product Storage Requirements:
    - a. All tanks must be vented. Tanks are designed for operation at atmospheric pressure.
    - b. Tanks shall be capable of storing liquids with specific gravity up to 1.1.
    - c. Maximum temperature. Tanks shall be listed by a nationally recognized laboratory and capable of storing gasoline, gasohol (90% gasoline and 10% ethanol mixture), 90.5% gasoline and 9.5% Oxinol-50 (4.75% methanol and 4.75% GTBA mixture), gas, jet fuel, diesel fuel, motor oil or oil at temperatures not to exceed 150° F at the tank interior surface.
    - d. Tanks shall be chemically inert to petroleum products.
  3. Dimensional Requirements (refer to Owens-Corning literature on gallonage):
    - a. Capacity: 15,000 gallons.
    - b. Nominal outside diameter of the tanks shall be 10 feet.
    - c. Approximate overall length of the tanks shall be 29 feet 2 inches.
  4. Monitoring Capabilities:

- a. Tanks shall have a space between the primary and secondary shell walls to allow for the free flow of liquid media and containment of all leaked product from the primary tank.
  - b. The following continuous monitoring conditions shall be compatible with the cavity between the inner and outer tanks:
    - (1) Vented to atmosphere.
    - (2) Sealed tank cavity.
    - (3) Vacuum - 3" mercury maximum.
    - (4) Positive Air Pressure - 3 PSI maximum.
    - (5) Hydrostatic pressure - 7 foot maximum groundwater head pressure over tank top.
  - c. Tanks shall have an integrally mounted reservoir installed on the tank for hydrostatic monitoring. The reservoir shall be constructed of fiberglass reinforced plastic materials and warranted for 30 years against failure due to internal/external corrosion and, when properly installed, against structural failure (same as tank warranty).
  - d. Tank shall be designed with access to the tank bottom between the primary and secondary walls (annular space). All tanks shall have one 4" NPT monitoring fitting in the reservoir. Tanks 4,000 gallon capacity and larger shall also have one 4" NPT monitoring fitting located on each end of the tank.
  - e. The double-wall tank monitor shall be capable of detecting a breach in the inner and/or outer tank under the following installed conditions:
    - (1) When the inner tank is empty.
    - (2) When the inner tank is partially or completely full and the ground water table is below the tank bottom.
    - (3) When the inner tank is partially or completely full and the tank is partially or completely submerged in groundwater.
  - f. The tank detection performance of the monitoring system shall be tested and verified by a qualified independent consultant to detect leaks as small as .05 gallons per hour with a 99% probability of detection and less than a 1% probability of a false alarm.
  - g. All monitoring equipment, including FRP reservoirs and electronic control shall be UL listed.
  - h. If hydrostatically monitored, any solution used in the tank annular space shall have UL approval for compatibility with the tank.
5. Accessories:
- a. Anchor straps to be glass fiber reinforced plastic anchor straps as supplied by the tank manufacturer.
  - b. Underwriters' Laboratory label shall be permanently affixed to each tank.
  - c. Manhole and Cover:
    - (1) All manways will be furnished complete with UL listed gaskets, bolts and covers.
    - (2) Location - See standard tank drawings.
    - (3) Fiberglass manway extension tubes 24" long will provide for the manways as outlined in Section 3 above.

- d. Fill tubes shall be fiber glass reinforced plastic, factory installed, 4" diameter, and shall include a 6" steel fitting with a double tapped reducer bushing to 4" diameter. Tubes shall be standard items as manufactured and installed by the tank manufacturer.
- e. Fiberglass Tank Bottom Sumps:
  - (1) Sumps shall be factory installed at the tank bottom directly under the center of manway.
  - (2) Sump will include a tank bottom deflector plate within the sump at the bottom.
  - (3) The sump will be 8" in diameter and 4" deep.
- f. Fittings - Threaded - NPT:
  - (1) All threaded fittings on U.L. labeled tanks for storage of petroleum products shall be of a material of construction consistent with the requirements of the U.L. label. All fittings to be supplied with threaded plugs.
  - (2) All standard threaded fittings are 4" in diameter and shall be half couplings. Reducers are to be used for smaller sizes where specified and provided by contractor.
  - (3) Thread Standards: All threaded fittings shall have machine tolerances in accordance with the ANSI standard for each fitting size.
  - (4) Strength: NPT fittings will withstand a minimum of 150 foot pounds of torque and 1,000 foot pounds of bending, both with 2:1 factor of safety.
- g. 6" secondary containment coupling surface mounted on tank. Monitoring by means of a "T" fitting and grade level monitoring. Both supply and return container couplings manifolded for monitoring by a single sensor.
- h. Manhole Interface Ring:
  - (1) Shall be constructed of minimum 1/4" thick steel plate. The interface ring shall include welded studs, bolts, washers, and cork gaskets to mount the interface ring and manhole cover to the tank manhole. The outer bolt pattern on the interface ring shall include welded nuts, bolts, washers, and compression ring (minimum 1/4" thick) to fasten the secondary containment membrane (contractor supplied) for the piping system to the interface ring.
  - (2) Interface rings shall be provided as required manhole.
- i. Steel Compression rings: Shall be constructed of minimum 1/4" thick carbon steel with bolt holes in a bolt hole circle to be compatible with the manhole cover bolt patterns.
- j. Fiberglass Attachment Rings: Shall be constructed of minimum 1/4" thick.
- k. Ladders: Shall be standard carbon steel supplied by the tank manufacturer. Refer to drawings for location. Access ladder shall be provided for manhole extension. Ladders shall meet OSHA requirements.
- l. Tank Lifting Lugs: Provide lifting lug(s) on all tanks. Lugs shall be capable of withstanding weight of tank with a safety factor of 3 to 1.

- m. Overfill Spill Container: Provide sufficient capacity to contain delivery hose contents if tank is overfilled.
- n. Provide overfill alarm switch in the vent line to alarm in the event of the overfill.

### PART 3 - EXECUTION

#### 3.1 GENERAL REQUIREMENTS

- A. Install all items in strict accordance with the manufacturers written installation instructions.
- B. Submit after completion, a copy of the installation checklist accompanying the storage tank.
- C. Marker tape should be installed above fuel oil supply, return and vent pipes. Locate tape 6" below finished grade.
- D. Excavate to a sufficient depth for a minimum of 3 foot earth cover from top at tank to grade; allowing for cast-in-place, reinforced concrete ballast pad, plus 6 inches of sand or pea gravel between ballast pad and tank. Excavation shall extend one foot around the perimeter of the tank. Should rock be present at the proposed elevation of the hold-down pad, excavate the rock a minimum of 12" below the pad elevation and backfill with crushed stone to achieve the elevation required for the hold-down pad.
- E. Place reinforcing and concrete as specified in Division 3. Excavation floor and walls may serve as forms. Use ASTM C150 Portland Cement concrete, Type I, with normal weight aggregate conforming to ASTM C33, and having a 28 day compressive strength of 3,000 PSI.
- F. Provide filter fabric at bottom of piping excavation as barrier in the event of a leak occurrence.
- G. Set tie down eyelets for hold-down straps in concrete ballast pad and tie to reinforcing steel.
- H. Place 6 inches of clean sand or pea gravel on top of ballast pad.
- I. An air test of the tank is required prior to installation in excavation. Tank shall be tested in accordance with manufacturer's recommendations prior to any fuel being placed in tank.
- J. Set tank on fill materials.
- K. Install hold down straps. Exercise special care to install in strict accordance with manufacturer's recommendation.
- L. Backfill excavation with clean pea gravel. Tamp backfill to consolidate. Take special care when installing backfill along bottom sides of tank to assure the bottom quadrant of the tank is fully supported by backfill.
- M. See Sections 15050 - Basic Mechanical Materials and Methods and Section 02200 - Earthwork for additional requirements.
- N. Installation shall be by a contractor trained by the tank manufacturer in the installation of fiberglass tanks.

- O. The under ground tank shall be protected from damage by overloading during construction.
- P. Water shall not be allowed in tank at any time and the tank shall be protected from flotation.
- Q. Slope tank as required for leak detection system to properly operate.
- R. The plugs at unused tank openings shall be removed, a pipe compound shall be added and the plugs shall be reinstalled in the unused openings.
- S. Suction Line and Return Line: Shall be installed on site by the contractor.
- T. Tank shall be tested prior to inspection of FDEP.
- U. No fuel shall be placed in the tank until the FDEP approves installation of the tank.
- V. Tank shall be filled with fuel by contractor as soon as it is anchored and backfilled.
- W. Complete all work listed in the manufacturer's checklist and obtain a certificate of use in accordance with Code.

### 3.2 ADDITIONAL REQUIREMENTS

- A. Double Wall Fiberglass Underground Fuel Storage Tank:
  - 1. Installation shall be by contractor trained and certified by the tank manufacturer in the installation of fiberglass tanks.
  - 2. All rigid piping shall be terminated a minimum of 4" from the bottoms of four, six, eight and ten foot diameter tanks and 6" from the bottom of 12 ft. O.A. tanks.
- D. Inventory Control and Tank Leak Detection System with Remote Electronic Panel:
  - 1. Install in accordance with manufacturers written installation instructions.
  - 2. Locate remote panel as indicated on drawings.
  - 3. Provide 115 V power supply to console from adjacent 115 V source provided by Division 16. Coordinate electrical service and control monitoring interface with electrical and controls sub-contractors.
  - 4. Provide necessary conduit and accessories for low voltage connection to probes. See Division 16 for material specification.
- E. Liquid Level Indicator:
  - 1. Install in location as indicated on drawings.
  - 2. Transmission tubing shall be installed in 3/4" conduit with sweep ells or long radius bends.
- F. Vent Cap: Install as indicated on drawings.
- G. Fill or Sounding Line Cap:
  - 1. Set cap in concrete slab, as detailed on drawings. Slab shall be crowned to assure water will run away from the cap.
  - 2. Label cap for proper usage, i.e., "Sounding Line", "Fill Cap".

- H. Fuel Oil Pump:
  - 1. Install pump with containment sump.
  - 2. Provide suction strainer and discharge check valve.
- I. Manhole and Cover: Install as indicated on drawings.
- J. Fuel Filter: Install as indicated on drawings.
- K. Dual or Single Slip Tank Fittings: Install as indicated on drawings.
- L. Overflow Prevention Valve: Install in accordance with manufacturer's written instructions.
- M. Piping Requirements: See Section 15060 - Pipe and Pipe Fittings.

END OF SECTION15605



## SECTION 15772 - PACKAGED HEAT PUMPS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 WORK INCLUDED

- A. Air to Air Packaged Heat Pumps, split system.

#### 1.3 QUALITY ASSURANCE

- A. Units shall be listed and labeled by U.L., ETL or a Nationally Recognized Testing Laboratory (NRTL).
- B. Units shall be ARI certified.

#### 1.4 SUBMITTALS

- A. Submit dimension drawings, performance and product data for acceptance. Include wiring diagrams.
- B. Product data, along with installation operation and maintenance instructions, shall be included in the operation and maintenance manuals.

### PART 2 - PRODUCTS

#### 2.1 ACCEPTABLE MANUFACTURERS

- A. Air to Air Packaged Heat Pumps, Split System:
  - 1. Carrier
  - 2. Trane
  - 3. York

#### 2.2 FABRICATION

- A. Air to Air Packaged Heat Pumps, Split System: Provide an air-to-air electric heat pump (outdoor unit) in combination with a direct expansion fan coil heat pump (indoor unit), fully piped, wired and operational. Heat pump shall be designed, tested, and fully charged for use with R-410A refrigerant. Heat pump shall be designed certified by UL and ARI, and complete package to have one (1) year limited parts warranty and compressor to have a four (4) year extended parts warranty.
  - 1. Outdoor Section:
    - a. Cabinet shall be constructed of commercial grade galvanized steel, primed and painted to manufacturer's standard color. Access doors with neoprene gaskets shall be provided to allow access to coil, fan, motor and controls. Mounting legs shall be provided.
    - b. Compressor shall be high efficiency hermetic reciprocating type or scroll type equipped with a crankcase heater, automatically reversible oil pump, internal high pressure protection, and internal vibration isolation.

- Compressor motor shall have both thermal and current sensitive overload protection. Compressor wiring for three phase motors shall be provided with an automatically resettable three phase power monitor to protect the compressor from single phase power conditions.
- c. Outdoor coil shall be constructed of copper tubing with mechanically bonded aluminum fins having all joints brazed, factory installed coil refrigerant metering device to be mounted on unit liquid service valve, with device internal components to be removable for cleaning or replacement. Coil to be protected by a vinyl coated grille.
  - d. Outdoor fan shall be propeller type, direct driven, balanced statically and dynamically, and arranged for vertical air discharge. Fan shall be weatherproofed and approved for outdoor use. Fan motor shall be factory lubricated and internally protected. Three phase motors shall be provided with an automatically resettable three phase power monitor to protect the compressor from single phase power conditions.
  - e. Controls shall provide compressor short cycle protection and shall prevent compressor restart for a minimum of five minutes after shutdown. Automatic defrost control shall be provided to accomplish defrosting when coil saturated suction temperature indicates freezing temperatures. Defrost sequence shall call for defrosting for periods of not more than ten minutes every ninety minutes. Liquid line low pressure switch, suction line accumulator with positive oil return, pressure relief switch and a loss of pressure indicator shall be provided.
  - f. Unit shall be equipped with filter drier, schrader access valves, refrigerant check valves in the refrigerant line, solenoid type reversing four-way valve to provide automatic changeover, and expansion devices with interconnecting tubing to provide proper refrigerant flow control.
  - g. Low refrigerant and high refrigerant cut-outs to be arranged in lock out circuit for manual reset. Control wiring terminal board and 24 volt control circuit transformer to be provided. Terminal board shall be designed to match indoor unit terminal board and furnished complete with factory wiring from board to all internal components and accessory thermostat terminals for standardized point-to-point connectors.

2. Indoor Section:

- a. Cabinet shall be constructed of commercial grade galvanized steel, primed and painted to manufacturer's standard color, and insulated with fireproof, permanent, odorless glass fiber material. Access to be all components shall be provided with neoprene gasketed access panel(s).
- b. Indoor coil shall be constructed of copper tubing with mechanically bonded aluminum fins having all joints brazed. Factory installed refrigerant metering device, refrigerant line fittings which permit mechanical connection on the liquid line and female sweat or mechanical connection on the gas line, and condensate pan with primary and auxiliary drain connections shall be provided.
- c. Fan shall be forward curved, centrifugal type, driven by factory lubricated multi-speed fan motor complete with internal overload protection, and resiliently mounted. Three phase motors shall be provided with an automatically resettable three phase power monitor to protect the compressor from single phase power conditions. Fan shall have horizontal air discharge with optional vertical air discharge.
- d. Unit shall be provided with factory installed electric heater for supplemental heating to mount in discharge air passage. Elements to be of heavy duty nichrome internally delta- connected on three phase. Heater to have line break high limit controls.

- e. Unit shall be provided with 1 inch medium efficiency throwaway filters. Initial and one replacement set to be provided with unit. Filter retaining rack to be arranged for removal and replacement in space allotted.
  - f. Provide remote low voltage thermostat with automatic cooling/heating function to provide compression cycling, provision for automatic fan cycling or for continuous fan operation, and system on/off selection.
3. Unit shall be provided with the following accessories:
- a. Unit shall have interface control when more than one outdoor unit (condenser) serves one indoor unit, where required.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

##### A. Air to Air Packaged Heat Pumps, Split System:

- 1. Install in accordance with manufacturer's recommendations.
- 2. All openings made in walls or the roof the piping/electrical shall be patched and sealed completely, using materials of similar to existing type construction, to the Owner's satisfaction.
- 3. All refrigerant piping shall follow refrigerant piping techniques.
- 4. Condensate traps shall be minimum 4 inches deep and shall be field installed. Install plug in condensate drain on opposite side of unit from traps. Condensate drain connection shall be not less than 3/4".
- 5. All wiring shall comply with applicable local and national codes. Final connections shall be made with liquid -tight type electrical conduit for ease in removal.
- 6. Thermostat and sub-base for wall mounting shall be as detailed on plans.
- 7. Maintain necessary access space for filter change and normal maintenance. Piping and electrical connections shall be so located as to eliminate any interference with removal and replacement of filter.
- 8. Maintain space clearances around heat pump per manufacturer's recommendation.
- 9. After installation of unit, all interconnecting piping, controls and wiring, check each unit for satisfactory operation of fan on continuous and automatic control setting, unit operation on cooling, change over and heating and so indicate on tag pasted on unit indicating: "Checked for proper operation on \_\_\_Date\_\_\_ by \_\_\_Name\_\_\_."
- 10. Insert installation and maintenance instructions and parts lists in a one inch ring binder marked "OPERATION AND MAINTENANCE INSTRUCTIONS" and furnish to Owner.

END OF SECTION 15772

**SECTION 15820 - FANS**

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 WORK INCLUDED

- A. Centrifugal downblast roof exhaust fans.
- B. In-line centrifugal fans.

1.3 QUALITY ASSURANCE

- A. All electrical components shall be UL listed or labeled.
- B. All fans shall be AMCA certified.
- C. All components in the conditioned air stream shall conform to the NFPA-90A Flame/Smoke/Fire Contribution Rating of 25/50/0.
- D. All electrical devices shall conform to NEMA standards.
- E. All wiring shall conform to the NEC.
- F. Provide Florida Product Approval Numbers for all Products required by the Florida Building Code (FAC 9N-3).
- G. Except where special motors are specified or required for the fan duty, all integral horsepower motors to be high efficiency type as specified in Section 15055 - Motors.

1.4 SUBMITTALS

- A. Submit dimension drawings, performance and product data for acceptance. Include fan curves with the system design point plotted, and second point showing compliance with 110% of design static pressure as required by paragraph 3.1 B. Also include fan efficiency and horsepower clearly indicated.
- B. Product data, along with installation operation and maintenance instructions, shall be included in the operation and maintenance manuals.
- C. Submit construction details and dimensional data including weights.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Centrifugal Downblast Roof Exhaust Fans:
  - 1. Acme Engineering and Manufacturing Corp.
  - 2. Barry Blower
  - 3. Greenheck Fan Corp.
  - 4. Loren Cook Co.

5. Penn Ventilator Co., Inc.
- B. In-line Centrifugal Fans:
1. Acme Engineering and Manufacturing Corp.
  2. Barry Blower
  3. Greenheck Fan Corp.
  4. Loren Cook Co.
  5. Penn Ventilator Co., Inc.

## 2.2 CONSTRUCTION

- A. Centrifugal Downblast Roof Exhaust Fans:
1. Direct or adjustable pitch belt drive as scheduled.
  2. Housing heavy gauge, aluminum, weatherproof.
  3. Wheels centrifugal type.
  4. Motor outside of air stream in isolated motor compartment with forced outside air cooling fan motor.
  5. Fan and motor on vibration isolation mounts.
  6. Motors continuous duty type permanently lubricated bearings factory wired to junction box with disconnect switch.
  7. Tip speed and motor horsepower shall not exceed catalog ratings.
  8. Accessories to include 18" sound attenuating curb, bird screen, back draft damper and hinged sub-base for damper access.
  9. Based on Loren Cook ACEB/ACED, Greenheck GB/G or approved equal.
- B. In-line Centrifugal Fans:
1. Heavy gauge aluminum housing with integral aluminum motor mounting base and straightening vanes heliarc mounted to housing at discharge end. Inlet and outlet flanges.
  2. Non-overloading, backwardly inclined aluminum air foil blower wheel with blades heliarc welded to the hub. Dynamically balanced. All wheels keyed to shaft.
  3. Belt drive or direct drive as scheduled with motor out of the airstream.
  4. Aluminum support bracket. Belt drive units to have locking strap and bolt to permit universal motor position.
  5. Grease lubricated anti-friction, self-aligning bearings having a minimum average life of 100,000 hours. Extended lubrication tubes.
  6. Belt drive units to have adjustable pitch belt drive designed for 140% of motor horsepower with a minimum of two oil resistant non-static belts. OSHA approved belt guard.
  7. Direct drive units to be provided with adequate motor cooling passages.
  8. Based on Loren Cook Type SQND/SQNB, Greenheck SQ/BSQ or approved equal.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Install in accordance with manufacturer's installation instructions.
- B. Provide fans capable of accommodating static pressure variations of plus 10 percent.
- C. Provide matched belts and balanced variable sheaves for motors 15 hp and under, and fixed sheaves for 20 hp and over. Provide belt and sheave changes if required for proper

air balancing.

- D. Provide belt guards on belt driven fans.
- E. Provide safety screen where inlet or outlet is exposed.
- F. Provide flexible connections on inlet and outlet of fans connected to ductwork as specified in Section 15860 -SHEET METAL SPECIALTIES.

END OF SECTION 15820

## SECTION 15840 - SHOP FABRICATED DUCTWORK

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 WORK INCLUDED

- A. Galvanized Steel Rectangular Ductwork.

#### 1.3 QUALITY ASSURANCE

- A. All ductwork shall be fabricated within the guidelines established by the Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA) HVAC Duct Construction Standards - Metal and Flexible, latest edition.
- B. All ductwork shall be fabricated to withstand the pressure and velocity required on this project.
- C. All components, fasteners, sealants, adhesives, etc. in the conditioned air stream or exposed in active or non- active plenums shall conform to the NFPA 90A Standard for the Installation of Air Conditioning and Ventilating Systems and Standard for Flame/Smoke/Fire Contribution of 25/50/0.
- D. All ductwork shall conform to UL standard UL 181 Factory Made Air Duct Materials and Duct Connectors, latest edition. Applicable sections shall apply to shop fabricated ductwork.
- E. After fabrication and installation of all shop fabricated ductwork the fabricator and installer, if not the same, shall certify in writing to the Owner's representative that all shop fabricated ductwork and installation of same meets or exceeds the quality standards established by SMACNA.

#### 1.4 SUBMITTALS

- A. Submission for acceptance is required.
- B. Product data, along with installation operation and maintenance instructions, shall be included in the operation and maintenance manuals.

#### 1.5 SHOP DRAWINGS

- A. Shop Drawings: Provide shop drawings of sheet metal ductwork as follows:
  - 1. Draw to a scale of not less than 1/4 inch to one foot on the same size sheets as the contract drawings.
  - 2. Show duct sizes.
  - 3. Show fitting details.
  - 4. Show lighting and ceiling diffusers.
- B. Shop Drawings for Field Erected Casings: Submit shop drawings for air handling unit casings, field erected casings and plenums.
  - 1. Draw to scale of 1/2 inch to 1 foot on the same size sheets as the contract drawings.

2. Show plan, sections, elevations and details of all joints and casings.
  3. Detail access doors and hardware.
  4. Detail coil, damper, humidifier, filter and fan installations. Provide access doors.
- C. Floor Plans: Provide sheet metal floor plans drawn to the same scale as the contract drawings.
1. Use contract drawing sheet size.
  2. Show on each floor plan the floor penetrations, fire dampers and access doors, ducts with sized and bottom elevations, terminal types and air quantities.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

#### A. Galvanized Steel Ductwork:

1. Interior, exposed or concealed: Hot rolled steel continuously annealed and hot dipped galvanized sheet or coil, minimum G-90, 0.90 oz/sf coating suitable for forming without flaking or peeling, suitable for welding or soldering. Zinc coating shall not be impaired from double seaming, breaking or roll forming. 14 ga. and lighter conforming to ASTM A 653. 13 ga and heavier conforming to ASTM A 653.
  2. Exterior or Areas Requiring Painting: Hot rolled steel continuously annealed and hot dipped galvanized sheet or coil, minimum G-90, 0.90 oz/sf (.001 inch thick/side) coating with a mill applied phosphate film suitable for insulating the paint from the drying action of the zinc, capable of forming without flaking or peeling, suitable for welding or soldering. Zinc coating shall not be impaired from double seaming, breaking or roll forming. 14 ga. and lighter conforming to ASTM A 653. 13 ga. and heavier conforming to ASTM A 653.
- B. Duct Sealants: Provide sealants with a maximum 25 flame spread, and maximum 50 smoke in the dry state, conforming to ASTM E 84, "Standard Test Method for Surface Burning Characteristics of Building Materials", and fire resistive and non-flammable in accordance with ASTM D 93, "Standard Test Methods for Flash Point" by "Pensky-Martens Closed Tester", when wet.

### 2.2 FABRICATION

#### A. Galvanized Steel Ductwork:

1. Fabricate ductwork as indicated on the drawings. Sizes given are inside clear dimensions. Allowances must be made for duct liner if indicated. Unless otherwise indicated on the drawings, the metal gauge shall be in accordance with SMACNA-HVAC Duct Construction Standards - Metal and Flexible, Latest Edition.
2. Elbow Fabrication:
  - a. 90 deg. elbows 12" or less in width shall be radiused whenever possible.
  - b. All radiused elbows shall be full radiused ( $R=1.5$ ).
  - c. All mitered 90 deg. elbows shall have turning vanes. Ducts with a width/depth ratio of 1 or more shall have double thickness turning vanes; single thickness is permissible for less than 1.
3. Tee or Take-off Fabrication:
  - a. Take-off to round run-outs shall be conical or bell mouth. Where conical or



- bellmouth fittings can not be used due to take-off size to main, provide factory fabricated side takeoff fitting equal to Flexmaster U.S.A., Inc. Type "STO". Provide with handle extension for insulated ducts to clear the insulation thickness specified.
- b. Take-off to square or rectangular shall be 45 deg. clinch collar or proportional divisions.
  - c. A volume damper shall be located downstream of each take off on square and rectangular take-offs, and integral to round run-outs.
4. Transitions:
- a. Concentric Transition: Maximum angle 45 deg. diverging, 60 deg. converging (SMACNA Fig. 2-7).
  - b. Eccentric Transition: Maximum angle 30 deg. diverging or converging (SMACNA Fig. 2-7).
5. At the Contractor's option, ductwork may be joined at the transverse joints with prefabricated galvanized Ductmate Industries, Inc. ("25" or "35") or Ward Industries, Inc. sections, or with fabricated TDF or TDC T-24 type flanged transverse joints with bolted corners, gaskets, and sealants, constructed in accordance with the SMACNA HVAC Duct Construction Standards - Metal and Flexible, latest edition, Table 1-12. Ductmate "25" may be used only on ductwork with a pressure classification of 2" w.g. or less on the discharge side of air handling units or fan power terminal units. Plastic joint clips are not acceptable. Flanged and prefabricated joints by different manufacturers shall not be jointed. Formed on flanges shall not be used.
- B. Ductwork, General: Each duct section shall have both ends covered with polyethylene or other suitable material to protect against the entrance of dirt, debris or water during shipment and storage prior to installation.

### PART 3 - EXECUTION

#### 3.1 GENERAL REQUIREMENTS

- A. Install in strict accordance with the Sheet Metal and Air Conditioning Contractor's National Association, Inc.'s (SMACNA) recommendations.
- B. The drawings, due to their small scale, are diagrammatic in nature and are not necessarily complete in all details. For this reason not all necessary offsets, risers or falls are shown. Coordinate the installation of the ductwork with all other trades and to provide all necessary offsets, etc. as required for completion of this project without any additional cost to the Owner, Architect and/or Engineer.
- C. All ductwork shall be run parallel or perpendicular to building structure whenever possible.
- D. All ductwork shall be properly sealed.
- E. Coordinate the location, provide the necessary access and install all devices provided in other specification sections within Division 15. Including but not limited to fire, smoke and/or balancing dampers, access and mounting for control devices, air flow measuring stations, etc. as apply to this project.
- F. All ducts passing through partitions or walls shall pass through at a 90 degree angle. The duct shall be sleeved with the space between the sleeve and duct properly sealed with firestopping material (Refer to Division 7 for Firestopping materials). The sleeve shall be permanently affixed to the wall (see Section 15090: Supports, Hangers, Anchors and

Sleeves for sleeve specifications).

- G. Coordinate the proper duct pressure classification with the systems served and to construct the ductwork to withstand these pressures. (See 3.6 Schedules; System Pressure Classification and Duct Material Schedules.)
- H. All ducts located outdoors and not of welded construction shall have seams and transverse joints sealed water tight with duct sealer, arranged to shed water and finished with insulating duct coating as specified in Section 15860 - Sheet Metal Specialties.

### 3.2 CLEANING AND PROTECTION

- A. During construction, ductwork shall be cleaned of dirt and debris internally section by section as it is installed. At end of each day, ductwork not finally connected to equipment shall be provided with a temporary closure of polyethylene film or other covering material that will prevent entrance of duct, debris or water. Clean exterior surfaces of any material which might cause corrosion or if the duct is to be painted, it shall be cleaned suitable for painting. After substantial completion of the ductwork system, the system shall be operated with filters in place to blow-out any remaining dust from the system. Protect all equipment and property from damage or fouling during this cleaning. All prefilters used during cleaning shall be replaced prior to turning the system over to the Owner.

### 3.3 DUCT SEALING REQUIREMENTS

- A. All ducts shall have SMACNA Seal Class A (all transverse joints, longitudinal seams and duct wall penetrations).

### 3.4 LEAK TESTING

- A. Duct Leakage Report: The Contractor shall make all the supply, return, outside air, and exhaust duct systems (limited to 1,500 cfm and greater) operationally air-tight, with no more than 2% leakage for duct systems rated at 2" w.c. pressure class, and 1% leakage for systems exceeding 2" w.c. pressure class. Leakage test to be performed by Contractor with all air device openings and fan connections sealed airtight. Test the systems prior to applying any insulation or concealing in soffits or chases. Use a portable fan capable of producing a static pressure equal or greater than the duct test pressure. This fan to have a flow measuring assembly consisting of a straight section of duct with an orifice plate, pressure taps, and a calibrated performance curve for determining leakage rates.
  1. Test each section equal to the external static pressure indicated for that fan or air handler with the portable fan assembly. After the fan achieves that steady state design pressure, record the air flow quantity across the orifice and the percent of design air flow. If the test fails, the Contractor shall reseal and retest at no additional cost to the Owner.
  2. Repair all duct leaks that can be heard or felt, even if the system has passed the leakage test.
  3. Submit duct leakage reports to the Balancer and the Engineer for their review and approval.
  4. Refer to specification section 15051 for more information.

### 3.5 INSTALLATION

- A. Galvanized Steel Ductwork:
  1. Install ductwork as indicated on the drawings. If any conflict occurs notify the Owner's Representative prior to any extensive rerouting.

2. Install ductwork to allow clearance for the installation of duct insulation.

3.6 SCHEDULES

- A. Ductwork shown to be round or oval is to be provided under Section 15846 - Pre-Fabricated Ductwork.

- B. System Pressure Classification and Duct Material Schedule for Shop Fabricated Ductwork:

<u>System</u>	<u>Section</u>	<u>Maximum Pressure</u>	<u>Duct Material</u>
1. Outside Air Duct		2" neg.	A
2. Supply	AHU to grille	3 pos.	A
3. Return	All AHU Return	1" neg.	A
4. General Exhaust	Inlet to Unit	1" neg.	A
5. Air Transfer Duct	All	2" neg.	A

Schedule Legend:

Duct Material

- A Galvanized Steel

END OF SECTION 15840

## **SECTION 15846 - PRE-FABRICATED DUCTWORK**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

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

#### **1.2 WORK INCLUDED**

- A. Single Wall Round or Flat Oval Galvanized Steel Ductwork and Fittings.
- B. Single Wall Round Snaplock Seam Galvanized Steel Ductwork and Fittings.
- C. Insulated Round Flexible Ductwork.

#### **1.3 QUALITY ASSURANCE**

- A. All ductwork shall be fabricated within the guidelines established by the Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA) HVAC Duct Construction Standards - Metal and Flexible, latest edition.
- B. All ductwork shall be fabricated to withstand the pressure and velocity required on this project.
- C. All components, fasteners, sealants, adhesives, etc. in the conditioned air stream or exposed in active or non- active plenums shall conform to the NFPA 90A Standard for the Installation of Air Conditioning and Ventilating Systems and Standard for Flame/Smoke/Fire Contribution of 25/50/0.
- D. All ductwork shall conform to UL standard UL 181 Factory Made Air Duct Materials and Duct Connectors, latest edition. Applicable sections shall apply to shop fabricated ductwork.
- E. After fabrication and installation of all shop fabricated ductwork the fabricator and installer, if not the same, shall certify in writing to the Owner's representative that all shop fabricated ductwork and installation of same meets or exceeds the quality standards established by SMACNA.

#### **1.4 SUBMITTALS**

- A. Submission for acceptance is required.
- B. Product data, along with installation operation and maintenance instructions, shall be included in the operation and maintenance manuals.

#### **1.5 SHOP DRAWINGS**

- A. Shop Drawings: Provide shop drawings of ductwork as follows:
  - 1. Draw to a scale of not less than 1/4 inch to one foot on the same size sheets as the contract drawings.
  - 2. Show duct sizes.
  - 3. Show fitting details.
  - 4. Show lighting and ceiling diffusers.

- B. Floor Plans: Provide sheet metal floor plans drawn to the same scale as the contract drawings.
  - 1. Use contract drawing sheet size.
  - 2. Show on each floor plan the floor penetrations, fire dampers and access doors, ducts with sizes and bottom elevations, terminal types and air quantities.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Single Wall Round or Flat Oval Galvanized Steel Ductwork and Fittings:

- 1. Autoduct, Inc.
- 2. Eastern Sheet Metal
- 3. Hamlin Sheetmetal, Inc.
- 4. Impulse Air.
- 5. Lindab
- 6. Semco Manufacturing, Inc.
- 7. United McGill

B. Single Wall Round Snaplock Seam Galvanized Steel Ductwork and Fittings:

- 1. Alco Manufacturing Company.
- 2. Crown Products Company.
- 3. Hughes.

C. Insulated Round Flexible Ductwork:

- 1. ATCO Rubber Products, Inc.
- 2. Flexmaster USA, Inc.
- 3. Flexible Technologies - Thermaflex®

2.2 FABRICATION

A. Single Wall Round or Flat Oval Ductwork and Fittings:

- 1. Materials: Hot rolled, continuously annealed, hot dipped galvanized steel minimum of G-90, 0.90 oz/sf coating, conforms to ASTM A653.
- 2. Metal Gauges: Conform to the Sheet Metal and Air Conditioning Contractor's National Association, Inc. (SMACNA) HVAC Duct Construction Standards - Metal and Flexible, latest edition. The following table shall establish a minimum guideline unless the manufacturer has U.L. Standard 181 test results that show that lighter gages (thinner wall thickness) with intermediate corrugations (ribs) allow the gage reduction:

Pipe Diameter	Positive Internal Static Pressure in W.G.					
	0" - 2.0"		2.1" - 4.0"		4.1" - 10.0"	
	Spiral		Spiral		Spiral	
	Pipe	Fittings	Pipe	Fittings	Pipe	Fittings
6" - 10"	28	26	28	24	28	24
12"	28	26	28	24	26	24
14"	28	26	26	24	26	24

16"	26	24	26	22	24	22
18" - 26"	26	24	24	22	24	22
27" - 36"	24	22	22	20	22	20
37" - 50"	22	20	20	20	20	20
51" - 60"	20	18	18	18	18	18
61" - 84"	18	16	18	16	18	16

Major Axis Dimension Positive Internal Static Pressure in W.G.

	0" - 2.0"		2.1" - 4.0"		4.1" - 10.0"	
	Flat Oval		Flat Oval		Flat Oval	
	Pipe	Fittings	Pipe	Fittings	Pipe	Fittings
6" - 24"	24	20	24	20	24	20
25" - 36"	22	20	22	20	22	20
37" - 48"	22	18	22	18	22	18
49" - 60"	20	18	20	18	20	18
61" - 70"	20	16	20	16	20	16
71" - Up	18	16	18	16	18	16

3. Duct Construction: Spiral wound, lockseam construction, slip joint or flanged connections as noted below under couplings.

4. Fitting Construction:

a. 90 Deg. and 45 Deg. Ells: Solid - welded seam construction for dust collector use, Solid - welded seam or spot welded and bonded for general use. Radiused ells to be full radiused unless otherwise noted, mitered ells to have single thickness, turning vanes, slip joint or flanged connections.

b. Tees or Crosses: Solid - welded seam construction for dust collector use, Solid - welded seam or spot welded and bonded for general use. Tangential, unless otherwise noted or detailed, conical take off or reduction, slip joint or coupled ends. 180 Deg. or 45 Deg. as indicated.

c. Bellmouth: Solid - welded seam construction for dust collector use, Solid - welded seam or spot welded and bonded for general use. Spun metal, smooth converging bellmouth, round, gauge equal or greater than connecting duct.

d. Access Section:

1) 7" Diameter and Less: Minimum 12" long flanged section, minimum four bolts per flange.

2) 8" Diameter and Larger: Round or rectangular access cover, on welded raised section, pressure sensitive release suitable for manual release or emergency vacuum release, chain retainer, (see Para. 3.5: Schedules for Sizes).

e. Couplings:

1) Joints 36" or less shall have 2" slip coupling.

2) 38" or over shall be spiral mate or oval mate.

f. Based on United McGill or approved equal.

B. Single Wall Round Snaplock Seam Galvanized Steel Ductwork and Fittings:

1. Materials: Hot rolled, continuously annealed, hot dipped galvanized steel

minimum of G-90, 0.90 oz/sf coating, conforms to ASTM A653.

2. Metal Gauges: Minimum of 26 gauge, with remaining sizes conforming to the Sheet Metal and Air Conditioning Contractor's National Association, Inc. (SMACNA) HVAC Duct Construction Standards Metal and Flexible, latest edition. The following table shall establish a minimum guideline:

Round Ducts:

<u>Duct Diameter</u>	<u>Spiral Pipe</u>	<u>Fittings and Longitudinal Seam Pipe</u>
3" thru 14"	26	24
15" thru 26"	24	22
27" thru 30"	22	20

3. Duct Construction: Snaplock seam construction, slip joint or flanged connections.
4. Fitting Construction:
  - a. 90 Deg. and 45 Deg. Ells: Adjustable ells to be full radiused unless otherwise noted, slip joint or flanged connections.
  - b. Tees or Crosses: Adjustable, unless otherwise noted or detailed, conical take off or reduction, slip joint or coupled ends. 180 Deg. or 45 Deg. as indicated.

C. Insulated Round Flexible Ductwork:

1. Low Pressure Application:
  - a. Factory fabricated assembly of a trilaminate of aluminum foil, fiberglass and polyester with a perm rating of .02, high tear strength and properties to resist temperature change, mildew and age hardening. It shall be mechanically locked, without adhesives, into a formed aluminum helix on the ducts outside surface. It shall be U.L. listed 181 Class 1 and comply with NFPA 90A and 90B. The material shall have a pressure rating not less than 6" w.g. positive pressure and -3" w.g. negative pressure through a temperature range of -20°F to +250°F.
  - b. The duct material shall be factory wrapped in a blanket of fiberglass insulation with a C factor of .23 or less. The insulation shall be encased in a fire retardant reinforced aluminum material vapor barrier with a perm rating of not over .05 grains per square ft. per hour per inch of mercury.
  - c. Based on Type 5M as manufactured by Flexmaster U.S.A., Inc., ATCO Rubber Products UPC #036 or Omni Air 1200, or Flexible Technologies – Thermaflex M-KF.

- D. Ductwork, General: Each duct section shall have both ends covered with polyethylene or other suitable material to protect against the entrance of dirt, debris or water during shipment and storage prior to installation.

- E. DUCT SEALANT: Water-Based Joint and Seam Sealant: Flexible, adhesive sealant, used indoors or outdoors. Foster 32-19 Duct Fas, Childers CP-146 Chil Flex or Duro Dyne SAS.

### PART 3 - EXECUTION

#### 3.1 GENERAL REQUIREMENTS:

- A. Install in strict accordance with the manufacturer's written installation instructions.
- B. The drawings, due to their small scale, are diagrammatic in nature and are not necessarily complete in all details. For this reason not all necessary offsets, rises or falls are shown. Coordinate the installation of the ductwork with all other trades and to provide all necessary offsets, etc. as required for completion of this project without any additional cost to the Owner, Architect or Engineer.
- C. All ductwork shall be run parallel or perpendicular to building structure and seams or spirals shall be aligned whenever possible.
- D. All sizes indicated on the drawings are inside clear dimensions.
- E. All ductwork shall be properly sealed in a neat clean manner with all excess sealer wiped clean.
- F. Coordinate the location of, provide the necessary access and install all devices provided in other specification sections within Division 15, including but not limited to fire, smoke and/or balancing dampers, access and mounting for control devices, air flow measuring stations, etc., as apply to this project.
- G. All ducts passing through partitions or walls shall be properly and neatly sealed. If partition or wall carries a fire rating (fire damper indicated or if architectural plans indicate a rated wall) the duct shall be sleeved with the space between the sleeve and duct properly sealed with firestopping material (Refer to Section 15050 and/or Division 7 for firestopping requirements). The sleeve shall be permanently affixed to the wall (see Section 15090: Supports, Hangers, Anchors and Sleeves for sleeve specification).
- H. Coordinate the proper duct pressure classification with the system served and to provide the proper ductwork to withstand these pressures. (See Para. 3.5 Schedules: System Pressure Classification and Duct Material Schedule.)

#### 3.2 CLEANING AND PROTECTION

- A. During construction, ductwork shall be cleaned of dirt and debris internally section by section as it is installed. At end of each day, ductwork not finally connected to equipment shall be provided with a temporary closure of polyethylene film or other covering material that will prevent entrance of dust, debris or water. Clean exterior surfaces of any material which might cause corrosion or if the duct is to be painted, it shall be cleaned suitable for painting. After substantial completion of the ductwork system the system shall be operated with filters in place to blow-out any remaining dust from the system. Protect all equipment and property from damage or fouling during this cleaning. All prefilters used during cleaning shall be replaced prior to turning the system over to the Owner.
- B. During field investigations, if the Owner or Engineer inspect ductwork and find dust, debris, water or any other contaminant the contractor will be responsible for cleaning or replacing, at the discretion of the Owner and Engineer, the ductwork section at the contractor's expense.

#### 3.3 LEAK TESTING



- A. Duct Leakage Report: The Contractor shall make all the supply, return, outside air, and exhaust duct systems (limited to 1,500 cfm and greater) operationally air-tight, with no more than 2% leakage for duct systems rated at 2" w.c. pressure class, and 1% leakage for systems exceeding 2" w.c. pressure class. Leakage test to be performed by Contractor with all air device openings and fan connections sealed airtight. Test the systems prior to applying any insulation or concealing in soffits or chases. Use a portable fan capable of producing a static pressure equal or greater than the duct test pressure. This fan to have a flow measuring assembly consisting of a straight section of duct with an orifice plate, pressure taps, and a calibrated performance curve for determining leakage rates.
1. Test each section equal to the external static pressure indicated for that fan or air handler with the portable fan assembly. After the fan achieves that steady state design pressure, record the air flow quantity across the orifice and the percent of design air flow. If the test fails, the Contractor shall reseal and retest at no additional cost to the Owner.
  2. Repair all duct leaks that can be heard or felt, even if the system has passed the leakage test.
  3. Submit duct leakage reports to the Balancer and the Engineer for their review and approval.
  4. Refer to specification section 15051 for more information.

### 3.4 INSTALLATION

- A. General:
1. Install generally as indicated.
  2. Conceal ductwork in finished spaces unless indicated otherwise.
  3. Do not install ductwork in or allow entering or passing through electrical rooms, elevator machine room, or spaces housing switchboards, panelboards or distribution boards, except ductwork that serves electrical rooms, elevator machine rooms or spaces.
  4. Exercise special care to provide tight fitting well fabricated, well braced ductwork systems.
  5. Field assemble rectangular, round or flat oval ductwork as follows:
    - a. Use slip joints, couplings, etc. sealed with adhesive pre-applied to couplings or duct mate spiral mate or oval mate on duct sizes 1" and larger.
    - b. Isolate dissimilar metals with elastomeric sealant tape or fiber gaskets and gaskets and washers for bolts.
  6. In high pressure ductwork (above 2" w.g.), do not use 2 piece mitered 90 degree elbows with or without vanes unless approved by engineer.
  7. Make duct connections from hoods, openings, fans and other devices.
- B. Insulated Round Flexible Ductwork:
1. Provide where indicated or required on supply air ducts.
  2. Coordinate the insulation requirements as to assure a continuous and consistent thermal resistance and vapor barrier.
  3. Maximum length shall be 5'-0".
  4. Maximum turn or bend shall be no more than 90 Deg. Provide rigid elbows where 90 Deg. turns are indicated on the drawings or more than one 90 Deg. turn is required.

5. Flexible ductwork shall be cut to the proper length. Coiling or unnecessary offsets will not be permitted.
6. Provide Stainless steel draw band to seal inner liner tight to connecting duct. Pull insulation over inner liner and fold vapor barrier over end of insulation. Secure with two coats of approved vapor barrier mastic, reinforced with glass cloth extending 2 inches onto adjacent insulation. One coat of mastic shall be applied to the insulation prior to the application of the glass cloth, which shall be embedded in the mastic to ensure complete adhesion of the cloth.
7. Rigid round ductwork may be substituted in lieu of flex unless the flex duct is used for vibration isolation or otherwise detailed. If omitted, external insulation must be provided per Section 15250 - Insulation.

### 3.5 SCHEDULES

#### A. System Pressure Classification and Duct Material Schedule:

System I.D. #	System	Section	Maximum Pressure	Duct Material
1.	Supply	AHU to Terminal	3" pos.	A
2.	Return	Terminal to AHU	2" neg.	A

#### Schedule Legend:

##### Duct Material

A Galvanized Steel

#### A. Access Door Schedule:

##### 1. Round Duct:

	<u>Duct Size</u>	<u>Access Door Size</u>
a.	up to 7" dia.	12" long removable section
b.	8" to 12" dia.	8" x 12"
c.	13" to 18" dia.	12" x 12"
d.	19" dia. and up	14" x 20"

##### 2. Flat Oval Duct

	<u>Duct Size</u> <u>Major Axis</u>	<u>Minor Access</u>	<u>Access Door Size</u>
a.	8" to 16"	8" to 11"	8" x 12"
b.	17" to 24"	12" to 13"	12" x 12"
c.	25" and up	14" and up	14" x 20"

END OF SECTION 15846

**SECTION 15860 - SHEET METAL SPECIALTIES**

**PART 1 – GENERAL**

**1.1 RELATED DOCUMENTS**

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

**1.2 WORK INCLUDED**

- A. Duct access doors.
- B. Fire dampers.
- C. Smoke dampers.
- D. Smoke/Fire dampers.
- E. Backdraft dampers.
- F. Volume dampers.
- G. Flexible duct connectors.
- H. Hardware cloth.

**1.3 QUALITY ASSURANCE**

- A. All products provided for enhancement of Life Safety shall be UL listed and bear the appropriate label stating compliance.
- B. All products located in the conditioned air stream or located in return air plenums shall conform to the NFPA 90A Flame/Smoke/Fuel Contribution of 25/50/0 and all other applicable requirements of NFPA 90A.
- C. Smoke and Smoke/Fire dampers shall be provided with a 60 month from the date of shipment parts only warranty, including freight for all components, including damper operators.
- D. Provide Florida Product Approval Numbers for all Products required by the Florida Building Code (FAC 9N-3).

**1.4 SUBMITTALS**

- A. Submission for acceptance is required.
- B. Product data, along with installation operation and maintenance instructions, shall be included in the operation and maintenance manuals.

**PART 2 - PRODUCTS**

**2.1 ACCEPTABLE MANUFACTURERS**

- A. Duct Access Doors:

1. Air Balance, Inc.
2. Cesco Products
3. Greenheck, Inc.
4. Nailor Industries, Inc.
5. Prefco Products, Inc.
6. Ruskin Manufacturing, Co.
7. Pottorff

B. Fire Dampers:

1. Air Balance, Inc.
2. Cesco Products
3. Greenheck, Inc.
4. Nailor Industries, Inc.
5. Prefco Products, Inc.
6. Ruskin Manufacturing, Co.
7. Pottorff

C. Smoke Dampers:

1. Air Balance, Inc.
2. Cesco Products
3. Greenheck, Inc.
4. Nailor Industries, Inc.
5. Prefco Products, Inc.
6. Ruskin Manufacturing, Co.
7. Pottorff

D. Smoke/Fire Dampers:

1. Air Balance, Inc.
2. Cesco Products
3. Greenheck, Inc.
4. Nailor Industries, Inc.
5. Prefco Products, Inc.
6. Ruskin Manufacturing, Co.
7. Pottorff

E. Backdraft Dampers:

1. Air Balance, Inc.
2. Cesco Products
3. Greenheck, Inc.
4. Nailor Industries, Inc.
5. Prefco Products, Inc.
6. Ruskin Manufacturing, Co.
7. Pottorff

F. Volume Dampers:

1. Air Balance, Inc.
2. Cesco Products
3. Greenheck, Inc.
4. Nailor Industries, Inc.
5. Prefco Products, Inc.
6. Ruskin Manufacturing, Co.

7. Pottorff

G. Flexible Duct Connectors:

1. Ductmate Industries, Inc.
2. Duro-Dyne
3. Elgen
4. Ventfabric

H. Hardware Cloth:

1. McNichols Co.
2. Owner Approved Equal.

## 2.2 FABRICATION

A. Duct Access Doors:

1. Low Pressure Ductwork:
  - a. Rating up to 2" wg positive or negative.
  - b. Frame: Minimum 22 gauge galvanized steel or aluminum, minimum 5/8" knock over edge, neoprene gasket between frame and duct and frame and door.
  - c. Door: Minimum 24 gauge galvanized steel or aluminum, continuous hinge and cam latches or minimum 2 cam latches, double wall construction, fiberglass insulated thickness to match ductwork.
  - d. Based on Ruskin Manufacturing Co. ADH24 or approved equal.

B. Fire Dampers:

1. Rating: 1-1/2 hours (UL approved for installation in 2 hour walls).
2. Construction: Minimum 24 gauge galvanized steel frame suitable for connection to ductwork without transition, minimum 24 gauge galvanized steel curtain type blades located out of the airstream, thickness coordinated with wall construction. Where an active smoke control system exists, the damper shall be capable of closing in an airstream moving at a minimum of 2000 feet per minute and operating at 4" w.g. pressure (dynamic damper).
3. Sleeves: UL listed minimum gauge galvanized steel with welded construction corners. Rollformed sleeves will not be acceptable unless contractor guarantees in writing to seal voids in sleeve with UL approved sealer to limit air leakage. Length of sleeve shall be coordinated with the wall or floor.
4. Operation: Stainless steel constant force closure spring.
5. Link Setting: 160 or 165°F.
6. Based on Ruskin Manufacturing Co. IBD2 Style B or approved equal. (Static Systems).  
Based on Ruskin Manufacturing Co., DIBD2 Style B or approved equal. (Active smoke control systems only).

C. Smoke Dampers:

1. Low and Medium Pressure Ductwork:
  - a. UL labeled under UL 555S low leakage rated, no more than 10 CFM/SF @ 1" w.g. (UL Class II) after exposure to 1000°F for 1 hour (non-degradable).

- Classified for both horizontal and vertical mounting.
- b. Construction:
    - 1) Frame 16 galvanized steel.
    - 2) Damper Blades: 14 gauge true airfoil design constructed of galvanized steel of low leakage non-heat degradable design with friction free silicone rubber edge type for a smoke seal to 450°F incorporated into blade and frame shapes. Blade shall be suitable for installation in systems with a maximum velocity of 4,000 FPM and 8" w.g. pressure at closure.
  - c. Damper operation by means of an electric actuator 120V AC, 24V AC or signal from smoke detector alarm circuit. Electric motor actuator to be UL listed with damper assembly for power open, spring closed operation with a maximum travel time of 15 seconds. Motor furnished with all connecting linkage and mounting hardware.
  - d. Damper and actuator shall be provided with a 60 month warranty as described in Paragraph 1.3.C.
  - e. Based on Ruskin Manufacturing Co., SD60-II or approved equal.
- D. Smoke/Fire Dampers:
- 1. Low and Medium Pressure Ductwork:
    - a. UL labeled under the following standards:
      - 1) UL 555 - 1-1/2 hr. fire endurance.
      - 2) UL 555S - Low leakage rated, no more than 10 CFM/SF @ 1" w.g. (UL Class II) after exposure to 1000°F for 1 hour (non-degradable).
      - 3) Classified for both horizontal and vertical mounting.
    - b. Construction: Single damper designed and rated for combination smoke/fire duty.
      - 1) Frame: 16 ga. galvanized steel.
      - 2) Damper Blades: 14 gauge true airfoil design constructed of galvanized steel of low leakage non-heat degradable design with friction free inflatable silicone coated fiberglass material to maintain smoke leakage rating to a minimum of 450°F and galvanized steel for flame seal to 1900°F. Blade shall be suitable for installation in systems with a maximum velocity of 2,000 FPM and 4" w.g. pressure at closure.
      - 3) Duct sleeve provided by others.
    - c. Operation:
      - 1) Smoke/fire damper operation by means of an integral resettable and re-useable UL listed electric-ambient temperature link, UL listed releasing device and mechanical lock assembly. Link activated by either electric, 120V AC or 24V AC signal from smoke detector alarm circuit or 350°F duct ambient temperature. Damper shall be capable of being reopened by remote signal when the duct temperature drops to 150°F. Electric motor actuator shall be UL listed with the damper assembly for power open/spring closed operation. Motor actuator shall be factory furnished with all connecting linkage and mounting hardware and shall be factory

- tested for proper operation.
  - 2) Damper and actuator shall be provided with a 60 month warranty as described in Paragraph 1.3.C.
  - d. Based on Ruskin Manufacturing, Co., FSD60-2 or approved equal.
- E. Backdraft Dampers:
- 1. Low Pressure Ductwork:
    - a. Rating: Up to 1" wg positive or negative.
    - b. Frame: Minimum 16 gauge (.064") galvanized steel or extruded aluminum.
    - c. Blades: Minimum 16 gauge (.064") galvanized steel or extruded aluminum parallel blade action, brass bearing, non-ferrous or de-iron pivot pins, gasketed blades.
    - d. Accessories: Counter balance and weights suitable for assisting or retarding as indicated on the drawings.
    - e. Based on Ruskin Manufacturing, Co. CBD4 or approved equal.
- F. Volume Dampers:
- 1. Provide volume dampers where indicated and construct as follows:
    - a. Provide single blades to a maximum of 10 inch blade width.
    - b. Provide inside end synthetic bearings and locking quadrants with wing nuts.
    - c. Friction locks are not permitted.
    - d. Break damper blades on both edges for stiffness.
    - e. Provide multi-blades on dampers 12 inches and larger with inside pins and molded synthetic bearings, and 2 inches wide by 1/8 inch thick structural galvanized channel frame.
    - f. Provide galvanized connecting bar with molded synthetic bearings on multi-blade dampers.
    - g. Provide stand off bracket for installation in externally insulated duct.
    - h. Based on Ruskin Manufacturing, Co. MD35 or approved equal for rectangular ducts (MDSR25 for round ducts) with velocities up to 1500 feet per minute.
    - i. Based on Ruskin Manufacturing, Co. CD30AF1 or approved equal for rectangular ducts (CDR82 for round ducts) with velocities over 1501 feet per minute.
- G. Flexible Duct Connectors:
- 1. Indoor Applications:
    - a. Material: Heavy glass fabric double - Coated with neoprene, Minimum of 30 oz/sy, Resistant to abrasion and damage due to repeated flexing, waterproof and air tight, minimum 26 gauge galvanized steel or .032" aluminum edge a minimum of 2-1/2" wide each side, coordinate flex width with schedule in 3.3: Schedules.
    - b. Rating:
      - (1) Temperature: -10°F to 200°F
      - (2) Pressure: 10" positive  
10" negative
      - (3) Based on Ventfabric and Ventglass or approved equal.

- H. Hardware Cloth: 4 mesh galvanized steel, plain weave with .035 wire.

### PART 3 - EXECUTION

#### 3.1 GENERAL REQUIREMENTS

- A. Install all products in strict accordance with the manufacturer's written installation instructions.
- B. Coordinate the installation of products provided within other sections of Division 15 including but not limited to control dampers, air flow measuring stations, etc.

#### 3.2 INSTALLATION

A. Duct Access Doors:

1. Coordinate the proper class access door with the system requirements.
2. Duct access doors shall be mounted so as to allow maximum access and/or door swing while also providing easy access from the floor or other personal accessible structures.
3. Duct access doors shall be provided wherever required for proper maintenance of equipment, access to duct mounted control devices, or visual inspection and setting of dampers, etc. All doors, due to the small scale of the drawings, may not be shown, it is the contractor's responsibility to coordinate with all trades concerned to provide the necessary quantity and properly locate all doors.

B. Fire Dampers:

1. Fire dampers shall be provided where indicated.
2. Review the architectural drawings to determine the wall construction rating so as to provide the proper rated damper.
3. All fire dampers shall be mounted within a UL approved thickness galvanized steel sleeve permanently affixed to the wall by means of perimeter retaining angles.
4. The fire damper shall be permanently attached to the sleeve. All voids around the sleeve and damper and sleeve and wall shall be properly sealed with fire barrier material. (See Section 15050: Basic Materials and Methods for Fire Barrier Material.)
5. Ductwork shall be attached to the fire damper by means of a UL approved break away connection.
6. Access doors or access sections shall be provided at all fire damper locations.

C. Smoke Dampers:

1. Provided where indicated. See combination smoke/fire damper for assemblies in fire rated barriers.
2. Review the architectural drawings to determine the wall construction rating so as to provide the proper rated damper.
3. Provide access doors or access sections at all damper locations.
4. Coordinate the provision of the smoke damper actuator with the automatic temperature control and fire alarm system and ensure adequate space for the mounting of the actuator during installation of the damper and ductwork.

D. Smoke/Fire Damper:

1. Provided where indicated. All smoke dampers in fire rated barriers to be



- combination type.
- 2. Review the architectural drawings to determine the wall construction rating so as to provide the proper rated damper.
- 3. All smoke/fire dampers shall be mounted within a UL approved thickness galvanized steel sleeve permanently affixed to the wall by means of perimeter retaining angles.
- 4. The smoke/fire damper shall be permanently attached to the sleeve. All voids around the sleeve and damper and sleeve and wall shall be properly sealed with fire barrier material.
- 5. Ductwork shall be attached to the smoke/fire damper by means of a UL approved break away connection.
- 6. Access doors or access sections shall be provided at all smoke/fire damper locations.
- 7. Coordinate the provision of the smoke damper actuator with the Building Control System and assure adequate space for the mounting of the actuator during installation of the smoke/fire damper and ductwork.
- 8. If pneumatic actuator is provided, all control tubing outside of the rated shaft shall be copper with 95-5 solder.

E. Backdraft Damper:

- 1. Securely attach backdraft damper to wall with a suitable sleeve and retaining angles and seal all voids between damper and wall.
- 2. Adjust damper to open or close under the design conditions.

F. Volume Dampers: Install at branch take-offs.

- 1. Install a 24" long yellow strip of material to each damper handle for easy visual location. These strips must be in place prior to Substantial acceptance.

G. Flexible Duct Connectors:

- 1. Flexible duct connectors shall be omitted where air handling units are provided with internally isolated fans and internal isolation.
- 2. Provide flexible duct connectors immediately adjacent to all in-line or ductwork connected fans and/or fan equipped units without internal vibration isolation.
- 3. Flexible duct connectors shall be properly selected and installed to ensure against collapsing under negative pressure and unacceptable ballooning under positive pressure. Leakage is not permissible. See width schedule in 3.3: Schedules.

H. Hardware Cloth: Install over all open ended ducts. Provide sheetmetal pocket over raw edges and secure with sheetmetal screws through the metal edge cover.

3.3 SCHEDULES

A. Access Door Schedule:

- 1. Square or Rectangular Duct work:

Access Door Mounting

	<u>Surface Max. Dim.</u>	<u>Access Door Size</u>
1.	6"	12" long Remov. Section
2.	7" to 8"	6" x 6"
3.	9" to 12"	8" x 8"

- |    |                    |           |
|----|--------------------|-----------|
| 4. | 13" to 18"         | 12" x 12" |
| 5. | 19" and up         | 16" x 16" |
| 6. | Special Situations | See Plans |

B. Flexible Duct Connector Schedule

1. Indoor and Outdoor Material Width Schedule

	<u>Duct Size</u> <u>(Max. Dim.)</u>	<u>Pressure</u> <u>(Max.)</u>	<u>Width</u>
a.	12" and less	positive	3"
b.	13" and up	positive	6"
c.	12" and less	negative	3"
d.	13" and up	negative	3"

END OF SECTION 15860

**SECTION 15870 - GRILLES, REGISTERS AND DIFFUSERS**

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Provisions of Section 15010, Mechanical General Provisions, shall be made an integral part of this section.

1.2 WORK INCLUDED

- A. Grilles.
- B. Registers.
- C. Diffusers.

1.3 QUALITY ASSURANCE

- A. Manufacturer shall certify cataloged performance and ensure correct application of all air outlet types.
- B. All components within the conditioned air stream or exposed in active or non-active plenums shall conform to the NFPA 90A standard for Flame/Smoke/Fire Contribution of 25/50/0.

1.4 SUBMITTALS

- A. Submit schedule and product data for acceptance. Coordinate submittal by "G" number and include construction details, capacity ratings including air side pressure drops and NC levels.
- B. Product data, along with installation operation and maintenance instructions, shall be included in the operation and maintenance manuals.

PART 2 – PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Grilles:
  - 1. Anemostat
  - 2. Krueger
  - 3. Metal Aire Division of Metal Industries, Inc.
  - 4. Nailor
  - 5. Price
  - 6. Titus
  - 7. Trox
- B. Registers:
  - 1. Anemostat
  - 2. Krueger

3. Metal Aire Division of Metal Industries, Inc.
4. Nailor
5. Price
6. Titus
7. Trox

C. Diffusers:

1. Anemostat
2. Krueger
3. Metal Aire Division of Metal Industries, Inc.
4. Nailor
5. Price
6. Titus
7. Trox

2.2 FABRICATION

- A. Fixture designations as shown on the drawings.

PART 3 - EXECUTION

3.1 GENERAL

- A. Install all devices in strict accordance with the manufacturer's written installation instructions.
- B. Coordinate the proper grille style and frame style with the final approved ceiling construction and install grilles, registers and diffusers in accordance with the requirements of the architectural reflected ceiling plan.
- C. Due to the small scale of the drawings the contractor shall assume the responsibility to coordinate the air outlet and inlet locations with the reflected ceiling plans, lighting plans, sections and or details.
- D. Any unlined or otherwise exposed parts beyond the grille, register or diffuser face exposed to sight shall be painted black.
- E. Coordinate the color requirements for all grilles, registers and diffusers with the Owner's Representative.
- F. Insulate the back pans of all diffusers per the requirements of Specification Section 15250.
- G. Air distribution devices installed in lay-in ceilings shall have a 24"x24" extended panel.
- H. Devices installed in sheetrock or other hard ceilings shall be surface mount type.

END OF SECTION 15870

## SECTION 15900 - BUILDING AUTOMATION SYSTEMS

### PART 1 - GENERAL

#### 1.1 General

- A. All work of this Division shall be coordinated and provided by the single Building Automation System (BAS) Contractor.
- B. The work of this Division shall be scheduled, coordinated, and interfaced with the associated work of other trades. Reference the Division 15 Sections for details.
- C. The work of this Division shall be as required by the Specifications, Point Schedules and Drawings.
- D. If the BAS Contractor believes there are conflicts or missing information in the project documents, the Contractor shall promptly request clarification and instruction from the design team.
- E. Refer to attached requirements from the Orange County Information Systems and Services (ISS) division for all Orange County hardware, software, and network requirements.

#### 1.2 BAS Description

- A. The Building Automation System (BAS) shall be a complete system designed for use with the enterprise IT systems. This functionality shall extend into the equipment rooms. Devices residing on the automation network located in equipment rooms and similar shall be fully IT compatible devices that mount and communicate directly on the IT infrastructure in the facility. Contractor shall be responsible for coordination with the owner's IT staff to ensure that the BAS will perform in the owner's environment without disruption to any of the other activities taking place on that LAN.
- B. All points of user interface shall be on standard PCs that do not require the purchase of any special software from the BAS manufacturer for use as a building operations terminal. The primary point of interface on these PCs will be a standard Web Browser.
- C. The work of the single BAS Contractor shall be as defined individually and collectively in all Sections of this Division specifications together with the associated Point Sheets and Drawings and the associated interfacing work as referenced in the related documents.
- D. The BAS work shall consist of the provision of all labor, materials, tools, equipment, software, software licenses, software configurations and database entries, interfaces, wiring, tubing, installation, labeling, engineering, calibration, documentation, samples, submittals, testing, commissioning, training services, permits and licenses, transportation, shipping, handling, administration, supervision, management, insurance, temporary protection, cleaning, cutting and patching, warranties, services, and items, even though these may not be specifically mentioned in these Division documents which are required for the complete, fully functional and commissioned BAS.
- E. Provide a complete, neat and workmanlike installation. Use only manufacturer employees who are skilled, experienced, trained, and familiar with the specific equipment, software, standards and configurations to be provided for this Project.
- F. Manage and coordinate the BAS work in a timely manner in consideration of the Project schedules. Coordinate with the associated work of other trades so as to not impede or delay the work of associated trades.
- G. The BAS as provided shall incorporate, at minimum, the following integrated features, functions and services:

1. Operator information, alarm management and control functions.
  2. Enterprise-level information and control access.
  3. Information management including monitoring, transmission, archiving, retrieval, and reporting functions.
  4. Diagnostic monitoring and reporting of BAS functions.
  5. Offsite monitoring and management access.
  6. Energy management
  7. Standard applications for terminal HVAC systems.
- H. Acceptable Manufacturers (NO SUBSTITUTIONS)
1. Reliable Controls
  2. Honeywell
  3. Johnson Controls
  4. Automated Logic Controls
  5. The Trane Company

### 1.3 Quality Assurance

#### A. General

1. The Building Automation System Contractor shall be the primary manufacturer-owned branch office or primary installer of said manufacturer that is regularly engaged in the engineering, programming, installation and service of total integrated Building Automation Systems.
2. The BAS Contractor shall be a recognized national installer and service provider of BAS.
3. The BAS Contractor shall have a branch facility within a 3-hour response time of the job site supplying complete maintenance and support services on a 24 hour, 7-day-a-week basis.
4. As evidence and assurance of the contractor's ability to support the Owner's system with service and parts, the contractor must have been in the BAS business for at least the last six (6) years and have successfully completed total projects of at least 10 times the value of this contract in each of the preceding five years.
5. The Building Automation System architecture shall consist of the products of a manufacturer regularly engaged in the production of Building Automation Systems, and shall be the manufacturer's latest standard of design at the time of bid.
6. Single source responsibility of supplier shall be the complete installation and proper operation of the BAS and control system and shall include debugging and proper calibration of each component in the entire system both existing and new.
7. The Building Automation System contractor shall provide the Owner with 24 months of future software system upgrades as part of their package. The upgrade period shall begin once the final completion has been signed off by the engineer of record for each project.

#### B. Workplace Safety And Hazardous Materials

1. Provide a safety program in compliance with the Contract Documents.
2. The BAS Contractor shall have a corporately certified comprehensive Safety Certification Manual and a designated Safety Supervisor for the Project.

3. The Contractor and its employees and subtrades shall comply with federal, state and local safety regulations.
4. The Contractor shall ensure that all subcontractors and employees have written safety programs in place that covers their scope of work, and that their employees receive the training required by the OSHA have jurisdiction for at least each topic listed in the Safety Certification Manual.
5. Hazards created by the Contractor or its subcontractors shall be eliminated before any further work proceeds.
6. Hazards observed but not created by the Contractor or its subcontractors shall be reported to either the General Contractor or the Owner within the same day. The Contractor shall be required to avoid the hazard area until the hazard has been eliminated.
7. The Contractor shall sign and date a safety certification form prior to any work being performed, stating that the Contractors' company is in full compliance with the Project safety requirements.
8. The Contractor's safety program shall include written policy and arrangements for the handling, storage and management of all hazardous materials to be used in the work in compliance with the requirements of the AHJ at the Project site.
9. The Contractor's employees and subcontractor's staff shall have received training as applicable in the use of hazardous materials and shall govern their actions accordingly.

C. Quality Management Program

1. Designate a competent and experienced employee to provide BAS Project Management. The designated Project Manger shall be empowered to make technical, scheduling and related decisions on behalf of the BAS Contractor. At a minimum, the Project Manager shall:
  - Manage the scheduling of the work to ensure that adequate materials, labor and other resources are available as needed.
  - Manage the financial aspects of the BAS Contract.
  - Coordinate as necessary with other trades.
  - Be responsible for the work and actions of the BAS workforce on site.

1.4 Work By Others

- A. The demarcation of work and responsibilities between the BAS Contractor and other related trades shall be as outlined in the BAS RESPONSIBILITY MATRIX

BAS RESPONSIBILITY MATRIX				
WORK	FURNISH	INSTALL	Low Volt. WIRING/TUBE	LINE POWER
BAS low voltage and communication wiring	BAS	BAS	BAS	N/A
BAS conduits and raceway	BAS	BAS	BAS	BAS
Automatic dampers	BAS	15	N/A	N/A
BAS Current Switches.	BAS	BAS	BAS	N/A
BAS Control Relays	BAS	BAS	BAS	N/A
All BAS Nodes, equipment, housings, enclosures and panels.	BAS	BAS	BAS	BAS

Smoke Detectors	16	16	16	16
Fire Alarm shutdown relay interlock wiring	16	16	16	16
Fire Alarm smoke control relay interlock wiring	16	16	BAS	16
Fan Coil Unit controls	BAS	BAS	BAS	16
Starters, HOA switches	16	16	N/A	16
Control damper actuators	BAS	BAS	BAS	16

## 1.5 Submittals

### A. Shop Drawings, Product Data, and Samples

1. The BAS contractor shall submit its qualifications to the Orange County's Representative after bidding has been completed but prior to the submittal of shop drawings. These qualifications shall be submitted within 15 days of contract award.
2. Once the BAS contractor receives approval from the Owner for their qualifications, the BAS contractor shall submit a list of all shop drawings with submittals dates within 45 days of contract award.
3. Submittals shall be in defined packages. Each package shall be complete and shall only reference itself and previously submitted packages. The packages shall be as approved by the Architect and Engineer for Contract compliance.
4. Allow 15 working days for the review of each package by the Architect and Engineer in the scheduling of the total BAS work.
5. Equipment and systems requiring approval of local authorities must comply with such regulations and be approved. Filing shall be at the expense of the BAS Contractor where filing is necessary. Provide a copy of all related correspondence and permits to the Owner.
6. Prepare an index of all submittals and shop drawings for the installation. Index shall include a shop drawing identification number, Contract Documents reference and item description.
7. The BAS Contractor shall correct any errors or omissions noted in the first review.
8. At a minimum, submit the following:
  - a. BAS network architecture diagrams including all nodes and interconnections.
  - b. Systems schematics, sequences and flow diagrams.
  - c. Points schedule for each point in the BAS, including: Point Type, Object Name, Expanded ID, Display Units, Controller type, and Address.
  - d. Samples of Graphic Display screen types and associated menus.
  - e. Detailed Bill of Material list for each system or application, identifying quantities, part numbers, descriptions, and optional features.
  - f. Control Damper Schedule including a separate line for each damper provided under this section and a column for each of the damper attributes, including: Code Number, Fail Position, Damper Type, Damper Operator, Duct Size, Damper Size, Mounting, and Actuator Type.
  - g. Control Valve Schedules including a separate line for each valve provided under this section and a column for each of the valve attributes: Code Number, Configuration, Fail Position, Pipe Size, Valve Size, Body Configuration, Close off Pressure, Capacity, Valve CV, Design Pressure, and Actuator Type.
  - h. Room Schedule including a separate line for each VAV box and/or terminal unit indicating location and address



- i. Details of all BAS interfaces and connections to the work of other trades.
- j. Product data sheets or marked catalog pages including part number, photo and description for all products including software.

## 1.8 Record Documentation

### A. Operation and Maintenance Manuals

1. Three (3) copies of the Operation and Maintenance Manuals shall be provided to the Owner's Representative upon completion of the project. The entire Operation and Maintenance Manual shall be furnished on Compact Disc media, and include the following for the BAS provided:
  - a. Table of contents.
  - b. As-built system record drawings. Computer Aided Drawings (CAD) record drawings on the latest version of AUTOCADD shall represent the as-built condition of the system and incorporate all information supplied with the approved submittal.
  - c. Manufacturers product data sheets or catalog pages for all products including software.
  - d. System Operator's manuals.
  - e. Archive copy of all site-specific databases and sequences.
  - f. BAS network diagrams.
  - g. Interfaces to all third-party products and work by other trades.
2. The Operation and Maintenance Manual CD shall be self-contained, and include all necessary software required to access the product data sheets. A logically organized table of contents shall provide dynamic links to view and print all product data sheets. Viewer software shall provide the ability to display, zoom, and search all documents.

## 1.9 Warranty

### A. Standard Material and Labor Warranty:

1. Provide a two-year labor and material warranty on the BAS.
2. If within twenty-four (24) months from the date of acceptance of product, upon written notice from the owner, it is found to be defective in operation, workmanship or materials, it shall be replaced, repaired or adjusted at the cost of the BAS Contractor.
3. Maintain an adequate supply of materials within 50 miles of the Project site such that replacement of key parts and labor support, including programming. Warranty work shall be done during BAS Contractor's normal business hours.

## 2. PART 2 - PRODUCTS

### 2.1 Network Area Controllers (NAC)

- A. The Network Area Controller (NAC) shall provide a thin-client, Graphical User Interface (GUI) to the Building Automation System (BAS).
  1. Local Access. The NAC shall be installed upon the owner's Local Area Network (LAN) and shall support local operator access using standard web browsers including at a minimum Microsoft Internet Explorer 8.

2. Remote Access. A high-speed connection from the NAC to the Wide Area Network (WAN) shall be provided and maintained by the owner to facilitate remote operator access to the BAS using the standard web browsers including at a minimum Microsoft Internet Explorer 8.
- B. The NAC(s) shall meet or exceed the requirements of a BACnet<sup>®</sup> Operator Workstation (B-OWS) and a BACnet<sup>®</sup> Building Controller (B-BC).
  - C. The NAC(s) shall not require any hardware, software or firmware licensing agreements.
  - D. The NAC(s) shall support the following hardware characteristics as a minimum:
    1. One ( 1 ) ISO-8802.3 Ethernet Port – 10/100 Mbps
    2. One EIA-232 Port – 115.2 Kbps maximum
    3. Two EIA-485 Ports – 76.8 Kbps maximum
    4. Local onboard and/or expandable hardware inputs/outputs (I/O)
      - a. Expandable to a minimum of 96 Inputs and 64 Outputs
    5. 8 MB operating RAM
    6. 1 MB non-volatile RAM
    7. 128 MB Flash EEPROM
  - E. The NAC(s) shall support the following communication protocols at a minimum:
    1. ASHRAE 135-2008 BACnet<sup>®</sup>
      - a. Point-to-Point (PTP)
      - b. Master Slave/Token Passing (MS/TP)
      - c. Ethernet
      - d. BACnet<sup>®</sup> IP (B/IP)
    2. Modbus
      - a. RTU (master or slave)
      - b. TCP (master or slave)
    3. Simple Mail Transfer Protocol (SMTP)
    4. Simple Network Management Protocol (SNMP)
    5. Hyper Text Transfer Protocol (HTTP)
    6. Short Message Service (SMS) – for GSM / GPRS modems
  - F. The NAC database and all necessary Graphical User Interface (GUI) resources including animations are to be stored on the NAC. Web-enabled applications that require system graphics to be stored on the client machines will not be acceptable.
  - G. The NAC shall support unlimited access by five (5) simultaneous clients
  - H. Multiple NAC devices shall be capable of being installed on the same BACnet<sup>®</sup> internetwork without any separate server applications, separate network management or additional licensing.
    1. Browser clients shall have the ability to access any NAC on the internetwork directly
  - I. The NAC shall provide native BACnet<sup>®</sup> communications directly with all BACnet<sup>®</sup> devices

on the BACnet® internetwork. Applications that require translation of data, gateways, or mapping of any kind shall not be acceptable.

1. The NAC shall provide BACnet® client and server functionality on all data links without any additional modules or licensing
- J. Real-time values displayed on the web browser shall update automatically without requiring a manual “refresh” of the web page.
- K. HTML programming shall not be required to create or display system graphics or data on a web page.
- L. A new point displayed on a B-OWS graphic screen shall appear automatically on the identical graphic screen served by the NAC with no further programming or file transfer required.
- M. The NAC shall be capable of automatically uploading any changes to existing GUI images or animations.
- N. The NAC shall support operator interface via the web browser the following at a minimum:
  1. Password Protection
    - a. Multiple-level password access protection shall be provided.
    - b. Passwords may be exactly the same for all software applications provided to communicate with the internetwork including the web-based browser interface. Passwords and access credentials shall be able to be imported from the B-OWS to the NAC.
    - c. A minimum of three (3) levels of access shall be supported with a configurable matrix of operator actions allowed for each access level, broken down into at least 20 possible operator actions
    - d. A minimum of 128 passwords shall be supported at each NAC
    - e. Operators will be able to perform only those commands available for their respective passwords.
    - f. User-definable, automatic log-off timers of from 1 to 60 minutes shall be provided to prevent operators from inadvertently leaving an NAC browser interface in an unsupervised logged-in state.
    - g. The NAC shall be configurable to provide read-only access without requiring log-on
    - h. Unencrypted passwords shall not be transmitted between the NAC and the client browser
  2. Alarming and Event Notification
    - a. NAC shall be capable of generating configurable automatic and dynamic alarm notification that is presented on-top of any current browsing screens in the form of a pop-up message
    - b. NAC shall be capable of e-mail and telephonic test message notification of system alarms configurable to include notification class, recipient, inclusive and exclusive times and days as well as transition states (to alarm, to fault, return to normal). Systems that use e-mail and/or text message as the exclusive means of annunciating alarms are not acceptable.
    - c. System shall provide log of notification messages.
    - d. Alarm messages shall be in user-definable text and shall be entered

- e. either at the B-OWS terminal or via remote communication
  - e. An alarm summary shall be available to show all alarms including but not limited to whether or not they have been acknowledged
  - f. System shall provide ability to prioritize and differentiate communications for at least 255 different levels of alarms
  - g. Alarm messages shall be fully customizable in size, content, behavior and sound.
3. Weekly, Annual and Special Event Exception Scheduling
- a. Provide ability to view and modify the schedule for the calendar week and up to 255 special events in a graphical format. Each calendar day and special event shall provide at least six time/value entries per day.
  - b. Provide the ability for the operator to select scheduling for binary, analog, or multi-state object values.
  - c. Provide the ability for the operator to designate days, date ranges, or repeating date patterns as exception schedules.
  - d. Provide the capability for the operator to define special or holiday schedules and to link the BACnet schedule to a BACnet calendar, thereby over-riding weekly schedule programming on holidays defined in the BACnet calendar.
  - e. There shall be a provision with proper password access to manually override each schedule.
  - f. Provide the capability to designate any exception schedule to be "Executed Once" then automatically cleared.
  - g. Provide the ability to name each exception schedule with a user defined term to describe each special event.
4. Trend Log Graphing
- a. All data points (both hardware and software) system-wide shall be assignable to a historical trending program by gathering configurable historical samples of object data stored in the local controller (B-BC, B-AAC, B-ASC).
  - b. All trend log information shall be displayable in text or graphic format. All information shall be able to be printed in black & white or color and exported directly to a Microsoft Excel Spreadsheet.
5. Runtime Log Information
- a. B-OWS Software shall be capable of displaying Runtime and On/Off Cycle data of all Binary data points (both hardware and software) system-wide. Runtime logs shall provide the following at a minimum:
    - 1) Total Accumulated Runtime
    - 2) Accumulated Starts Today
    - 3) Total Accumulated Starts
    - 4) Timestamp each Start/Stop and duration of each on/off cycle
    - 5) Monitor equipment status and generate maintenance messages based upon user designated run time
6. Ability to Manually Override any Database point

- a. All hardware and software points may be temporarily overridden for a user adjustable configured time period
- 7. Custom navigation file tree
- 8. Color Graphical User Interface (GUI)
  - a. All color graphic displays shall be dynamic with current point data automatically updated from the BACnet internetwork to the browser without operator intervention. Manual operator intervention shall use the same methodology as on the B-OWS application.
  - b. Depending upon configured access level; the operator shall be able to manually adjust digital, analog or calculated values in the system, adjust values of control loops, override points or release points to automatic mode.
- O. The NAC shall provide the capability to create individual user (as determined by the log-on user identification) home pages. Provide the ability to limit a specific user to a defined home page. From the home page, links to other views, or pages in the system shall be possible, if allowed by the system administrator.
- P. The NAC shall include an Audit Trail feature that automatically records the time, date, and user, and action associated with all user changes made via Web Browser clients.
- Q. The NAC shall store complete help files describing system configuration, and use of the browser interface, the help files shall be served on-line as part of the browser interface.
  - 1. The web browser interface shall include tool tips to describe the functionality of the interface.

## 2.2 Advanced Applications Controllers (AAC)

- A. General
  - 1. Provide a micro-processor based, networkable, custom programmed, BACnet<sup>®</sup> Advanced Application Controller for each heat pump, etc, wall-mounted where shown on floor-plans. Each AAC shall include an LCD user interface and all input/output points required to monitor and control each unit as a stand-alone system, according to the specified sequence of operation. In addition AAC's shall allow monitoring and remote control via a supervisory network (BACnet) with a WEB-Based Browser-accessible front end.
  - 2. Provide a 5 year standard manufacturer's warranty for the AAC
- B. Network Protocol and Operator Connections
  - 1. The AAC's shall allow direct connection to a host network using BACnet<sup>®</sup> MS/TP (EIA-485) protocol. The network communication speed shall be operator selectable up to 76.8 kbps.
  - 2. Each AAC shall be BTL tested, and listed to meet the B-AAC Standard Device Profile including BIBBs for this level of device. A Protocol Implementation Conformance statement for the AAC proposed shall be submitted along with shop drawings. Network points to be viewable on each AAC are listed in the sequence of operation, however provide a minimum of 32 Read/Write objects per AAC.

3. Each AAC shall include an externally mounted port allowing operators to connect a laptop computer directly to the AAC for network configuration, custom programming, and trouble-shooting.

#### C. Hardware Components

1. Provide the following hardware input points at minimum in each AAC:
  - a. Room temperature sensor, local or remote 10K thermistor with an accuracy of +/- 0.1 Deg C
  - b. User set-point adjustment control with programmable set-point limits
  - c. On-board room humidity sensor, with replaceable CMOSense element, overall accuracy of +/- 1.8 % over 10 – 90 % range
  - d. On-board room passive infra-red occupancy sensor, with a maximum detection distance of 5m (16.4 ft), and 64 detection zones
  - e. In addition to the above, provide 4 user-definable universal inputs capable of accepting 0 -5 VDC, 4 – 20 mA, 10K thermistor, or dry contacts. Refer to the sequence of operation for specific input point requirements as referenced on the drawings.
2. Provide hardware analog and digital output points as required by the sequence of operation, however include the following point types at minimum to allow for future expansion:
  - a. Six universal outputs, user-definable as analog or digital
  - b. Two additional digital output points
  - c. Digital output points shall be dry contacts capable of switching 0.5 Amps at 24 VAC.
3. Provide a large LCD screen for display and adjustment of AAC points and mapped network points. Security codes MUST be provided to prevent unauthorized access from the local LCD screen. Minimum LCD size shall be 128 x 64 pixels. The screen shall be back-lit, however the light may be configured to shut off after a programmable inactive time.
4. Provide push-buttons on the panel face to facilitate navigation, point adjustment, data entry, and switching of operational modes (password protected).
5. AAC memory shall include a minimum 64 Kb RAM for logs and temporary data, and 512 kb flash EEPROM for non-volatile storage of firmware configuration and custom database. Provide a 24 hour clock and 365 day calendar on-board. Clock accuracy shall be +/- 1 second over 24 hours, and system time shall be retained during power outages exceeding 7 years.
6. Provide a software configurable buzzer which shall be set-up to trigger on the occurrence of selected alarms, and shall be audible and acknowledgeable either to all users, or only to those users with sufficient password authority.
7. AAC's shall be capable of monitoring and controlling at least 4 networked, remote temperature sensors, each with adjustable set-point and outputs for zone controls. These networked sensors shall not consume input/output points in the AAC.

#### D. Custom Configuration

1. Each AAC shall allow custom setup of the primary user interface screen; definition of all points to be monitored, controlled and displayed; alarms; schedules; trends; password access; and programmed sequence of operation as required to optimize the AAC for the specific requirements of this project, and

also to allow future modification by the owner. AAC's using canned programs for pre-determined HVAC applications are not acceptable.

2. Each AAC shall allow the following custom set-up at minimum:
  - a. Primary User Interface screen set-up, including display of time, system mode, fan mode, primary temperature display, and display of up to 3 additional operator-defined AAC or network points.
  - b. ALL physical Inputs AND Outputs of the controller MUST be able to be overridden at the LCD screen for technician checkout of the system locally.
  - c. Seven additional user defined point groups, each including up to six AAC or network points per group, to be displayed and adjusted by system users with sufficient password authority. Each group, and each individual point shall be defined to allow/disallow editing and manual override by users, and the password level required. Point definition shall also determine if units are to be displayed, and whether point names are displayed as text, or alternatively using an icon chosen from an on-board list of industry standard symbols.
  - d. Custom programs of 2000 bytes each, using a BASIC control language, with source code stored on board.
  - e. The AAC may be defined with full access by all users without password protection, or with three levels of password protected access. Each level of access shall be enabled by entering a 4 digit password via the front panel keys. AAC's that require removal of the faceplate to unlock the keyboard are not acceptable.
  - f. Alarm states shall be defined using AAC custom programming, with the definition including the password level required to acknowledge, reset, and clear alarms. When an AAC alarm condition exists, an alarm icon shall be displayed on all screens.
  - g. 48 user-definable program-driven variables, with selectable ranges and standard or custom units.
  - h. user-definable PID controls loops
  - i. user-definable trend logs, each with 150 samples of 6 points each, and programmable sampling times
  - j. 8 user-definable runtime logs to accumulate the run-times of selected digital points, and record the time and date of the last 100 changes of state
  - k. 2 user-definable system groups, 50 points per group, allowing related points to be grouped together on one display for use in network graphics
  - l. 1 user-definable weekly schedule, including 4 on/off pairs for each weekday, and two additional daily schedules triggered by the annual schedule or by custom programming
  - m. Override of the unoccupied schedule for a programmed period of time shall be triggered via a front panel button
  - n. 1 annual schedule, allowing pre-programming of holidays 365 days in advance

## 2.3 Input Devices

### A. General Requirements

1. Installation, testing, and calibration of all sensors, transmitters, and other input devices shall be provided to meet the system requirements.
2. Outside Air Sensors

- a. Outside air sensors shall be designed to withstand the environmental conditions to which they will be exposed. They shall also be provided with a solar shield.
    - b. Sensors exposed to wind velocity pressures shall be shielded by a perforated plate that surrounds the sensor element.
    - c. Temperature transmitters shall be of NEMA 3R construction and rated for ambient temperatures.
  - 3. Duct Mount Sensors
    - a. Duct mount sensors shall mount in an electrical box through a hole in the duct, and be positioned so as to be easily accessible for repair or replacement.
    - b. Duct sensors shall be insertion type and constructed as a complete assembly, including lock nut and mounting plate.
    - c. For outdoor air duct applications, a weatherproof mounting box with weatherproof cover and gasket shall be used.
  - 4. Averaging Sensors
    - a. For ductwork greater in any dimension than 48 inches and/or where air temperature stratification exists, an averaging sensor with multiple sensing points shall be used.
    - b. For plenum applications, such as mixed air temperature measurements, a string of sensors mounted across the plenum shall be used to account for stratification and/or air turbulence. The averaging string shall have a minimum of 4 sensing points per 12-foot long segment.
    - c. Capillary supports at the sides of the duct shall be provided to support the sensing string.
  - 5. Acceptable Manufacturers: Setra or approved equal.
- B. Humidity Sensors
  - 1. The sensor shall be a solid-state type, relative humidity sensor of the Bulk Polymer Design. The sensor element shall resist service contamination.
  - 2. The humidity transmitter shall be equipped with non-interactive span and zero adjustments, a 2-wire isolated loop powered, 4-20 mA, 0-100% linear proportional output.
  - 3. The humidity transmitter shall meet the following overall accuracy, including lead loss and Analog to Digital conversion. 3% between 20% and 80% RH @ 77 Deg F unless specified elsewhere.
  - 4. Outside air relative humidity sensors shall be installed with a rain proof, perforated cover. The transmitter shall be installed in a NEMA 3R enclosure with sealite fittings and stainless steel bushings.
  - 5. A single point humidity calibrator shall be provided, if required, for field calibration. Transmitters shall be shipped factory pre-calibrated.
  - 6. Duct type sensing probes shall be constructed of 304 stainless steel, and shall be equipped with a neoprene grommet, bushings, and a mounting bracket.
  - 7. Acceptable Manufacturers: Veris Industries, Mamac, or approved equal.
- C. Differential Pressure Transmitters
  - 1. General Air and Water Pressure Transmitter Requirements:
    - a. Pressure transmitters shall be constructed to withstand 100% pressure over-range without damage, and to hold calibrated accuracy when subject to a momentary 40% over-range input.
    - b. Pressure transmitters shall transmit a 0 to 5 VDC, 0 to 10 VDC, or 4 to 20 mA output signal.



- c. Differential pressure transmitters used for flow measurement shall be sized to the flow sensing device, and shall be supplied with Tee fittings and shut-off valves in the high and low sensing pick-up lines to allow the balancing Contractor and Owner permanent, easy-to-use connection.
- d. A minimum of a NEMA 1 housing shall be provided for the transmitter. Transmitters shall be located in accessible local control panels wherever possible.

D. Status and Safety Switches

1. General Requirements

- a. Switches shall be provided to monitor equipment status, safety conditions, and generate alarms at the BAS when a failure or abnormal condition occurs. Safety switches shall be provided with two sets of contacts and shall be interlock wired to shut down respective equipment.

2. Current Sensing Switches

- a. The current sensing switch shall be self-powered with solid-state circuitry and a dry contact output. It shall consist of a current transformer, a solid state current sensing circuit, adjustable trip point, solid state switch, SPDT relay, and an LED indicating the on or off status. A conductor of the load shall be passed through the window of the device. It shall accept over-current up to twice its trip point range.
- b. Current sensing switches shall be used for run status for fans, pumps, and other miscellaneous motor loads.
- c. Current sensing switches shall be calibrated to show a positive run status only when the motor is operating under load. A motor running with a broken belt or coupling shall indicate a negative run status.
- d. Acceptable manufacturers: Veris Industries or approved equal.

3. Air Flow Switches

- a. Differential pressure flow switches shall be snap acting micro-switches with appropriate scale range and differential adjustment for intended service.
- b. Acceptable manufacturers: Cleveland Controls or approved equal.

4. Low Temperature Limit Switches

- a. The low temperature limit switch shall be of the manual reset type with Double Pole/Single Throw snap acting contacts rated for 16 amps at 120VAC.
- b. The sensing element shall be a minimum of 15 feet in length and shall react to the coldest 18-inch section. Element shall be mounted horizontally across duct in accordance with manufacturers recommended installation procedures.
- c. For large duct areas where the sensing element does not provide full coverage of the air stream, additional switches shall be provided as required to provide full protection of the air stream.

2.4 Output Devices

A. Actuators

1. General Requirements

- a. Damper and valve actuators shall be electronic as specified in the System Description section.

2. Electronic Damper Actuators

- a. Electronic damper actuators shall be direct shaft mount.

- b. Modulating and two-position actuators shall be provided as required by the sequence of operations. Damper sections shall be sized Based on actuator manufacturer's recommendations for face velocity, differential pressure and damper type. The actuator mounting arrangement and spring return feature shall permit normally open or normally closed positions of the dampers, as required. All actuators (except terminal units) shall be furnished with mechanical spring return unless otherwise specified in the sequences of operations. All actuators shall have external adjustable stops to limit the travel in either direction, and a gear release to allow manual positioning.
- c. Modulating actuators shall accept 24 VAC or VDC power supply, consume no more than 15 VA, and be UL listed. The control signal shall be 2-10 VDC or 4-20 mA, and the actuator shall provide a clamp position feedback signal of 2-10 VDC. The feedback signal shall be independent of the input signal and may be used to parallel other actuators and provide true position indication. The feedback signal of one damper actuator for each separately controlled damper shall be wired back to a terminal strip in the control panel for trouble-shooting purposes.
- d. Two-position or open/closed actuators shall accept 24 or 120 VAC power supply and be UL listed. Isolation, smoke, exhaust fan, and other dampers, as specified in the sequence of operations, shall be furnished with adjustable end switches to indicate open/closed position or be hard wired to start/stop associated fan. Two-position actuators, as specified in sequences of operations as "quick acting," shall move full stroke within 20 seconds. All smoke damper actuators shall be quick acting.
- e. Acceptable manufacturers: Belimo or approved equal.

B. Control Dampers

- 1. The BAS Contractor shall furnish all automatic dampers. All automatic dampers shall be sized for the application by the BAS Contractor or as specifically indicated on the Drawings.
- 2. All dampers used for throttling airflow shall be of the opposed blade type arranged for normally open or normally closed operation, as required. The damper is to be sized so that, when wide open, the pressure drop is a sufficient amount of its close-off pressure drop to shift the characteristic curve to near linear.
- 3. All dampers used for two-position, open/close control shall be parallel blade type arranged for normally open or closed operation, as required.
- 4. Damper frames and blades shall be constructed of either galvanized steel or aluminum. Maximum blade length in any section shall be 60". Damper blades shall be 16-gauge minimum and shall not exceed eight (8) inches in width. Damper frames shall be 16-gauge minimum hat channel type with corner bracing. All damper bearings shall be made of reinforced nylon, stainless steel or oil-impregnated bronze. Dampers shall be tight closing, low leakage type, with synthetic elastomer seals on the blade edges and flexible stainless steel side seals. Dampers of 48"x48" size shall not leak in excess of 8.0 cfm per square foot when closed against 4" w.g. static pressure when tested in accordance with AMCA Std. 500.
- 5. Airfoil blade dampers of double skin construction with linkage out of the air stream shall be used whenever the damper face velocity exceeds 1500 FPM or system pressure exceeds 2.5" w.g., but no more than 4000 FPM or 6" w.g. Acceptable manufacturers are Ruskin CD50, Vent Products 5650 or approved equal.

6. One piece rolled blade dampers with exposed or concealed linkage may be used with face velocities of 1500 FPM or below. Acceptable manufacturers are: Ruskin CD36, Vent Products 5800 or approved equal.
7. Multiple section dampers may be jack-shafted to allow mounting of direct connect electronic actuators. Each end of the jackshaft shall receive at least one actuator to reduce jackshaft twist.

C. Control Relays

1. Control Pilot Relays
  - a. Control pilot relays shall be of a modular plug-in design with retaining springs or clips.
  - b. Mounting Bases shall be snap-mount.
  - c. DPDT, 3PDT, or 4PDT relays shall be provided, as appropriate for application.
  - d. Contacts shall be rated for 10 amps at 120VAC.
  - e. Relays shall have an integral indicator light and check button.
  - f. Acceptable manufacturers: Lectro or approved equal.

2.5 Miscellaneous Devices

A. Power Supplies

1. DC power supplies shall be sized for the connected device load. Total rated load shall not exceed 75% of the rated capacity of the power supply.
2. Input: 120 VAC +10%, 60Hz.
3. Output: 24 VDC.
4. Line Regulation: +0.05% for 10% line change.
5. Load Regulation: +0.05% for 50% load change.
6. Ripple and Noise: 1 mV rms, 5 mV peak to peak.
7. An appropriately sized fuse and fuse block shall be provided and located next to the power supply.
8. A power disconnect switch shall be provided next to the power supply.

3. PART 3 – EXECUTION

3.1 BAS Specific Requirements

A. Graphic Displays

1. Provide a color graphic system flow diagram display for each system with all points as indicated on the point list. All terminal unit graphic displays shall be from a standard design library.
2. User shall access the various system schematics via a graphical penetration scheme and/or menu selection. .

B. Custom Reports:

1. Provide custom reports as required for this project:

C. Actuation / Control Type

1. Primary Equipment
  - a. Controls shall be provided by equipment manufacturer as specified herein.

- b. All damper and valve actuation shall be electric.
- 2. Air Handling Equipment
  - a. All air handlers shall be controlled with a HVAC-DDC Controller
  - b. All damper and valve actuation shall be electric.

### 3.2 Installation Practices

#### A. BAS Wiring

- 1. All conduit, wiring, accessories and wiring connections required for the installation of the Building Automation System, as herein specified, shall be provided by the BAS Contractor unless specifically shown on the Electrical Drawings under Division 16 Electrical. All wiring shall comply with the requirements of applicable portions of Division 16 and all local and national electric codes, unless specified otherwise in this section.
- 2. All BAS wiring materials and installation methods shall comply with BAS manufacturer recommendations.
- 3. The sizing, type and provision of cable, conduit, cable trays, and raceways shall be the design responsibility of the BAS Contractor. If complications arise, however, due to the incorrect selection of cable, cable trays, raceways and/or conduit by the BAS Contractor, the Contractor shall be responsible for all costs incurred in replacing the selected components.
- 4. Class 2 Wiring
  - a. All Class 2 (24VAC or less) wiring shall be installed in conduit unless otherwise specified.
  - b. Conduit is not required for Class 2 wiring in concealed accessible locations. Class 2 wiring not installed in conduit shall be supported every 5' from the building structure utilizing metal hangers designed for this application. Wiring shall be installed parallel to the building structural lines. All wiring shall be installed in accordance with local code requirements.
- 5. Class 2 signal wiring and 24VAC power can be run in the same conduit. Power wiring 120VAC and greater cannot share the same conduit with Class 2 signal wiring.
- 6. Provide for complete grounding of all applicable signal and communications cables, panels and equipment so as to ensure system integrity of operation. Ground cabling and conduit at the panel terminations. Avoid grounding loops.

#### B. BAS Line Voltage Power Source

- 1. 120-volt AC circuits used for the Building Automation System shall be taken from panel boards and circuit breakers provided by Division 16.
- 2. Circuits used for the BAS shall be dedicated to the BAS and shall not be used for any other purposes.
- 3. DDC terminal unit controllers may use AC power from motor power circuits.

#### C. BAS Raceway

- 1. All wiring shall be installed in conduit or raceway except as noted elsewhere in this specification. Minimum control wiring conduit size 1/2".
- 2. Where it is not possible to conceal raceways in finished locations, surface raceway (Wiremold) may be used as approved by the Architect.

3. All conduits and raceways shall be installed level, plumb, at right angles to the building lines and shall follow the contours of the surface to which they are attached.
  4. Flexible Metal Conduit shall be used for vibration isolation and shall be limited to 3 feet in length when terminating to vibrating equipment. Flexible Metal Conduit may be used within partition walls. Flexible Metal Conduit shall be UL listed.
- D. Penetrations
1. Provide fire stopping for all penetrations used by dedicated BAS conduits and raceways.
  2. All openings in fire proofed or fire stopped components shall be closed by using approved fire resistive sealant.
  3. All wiring passing through penetrations, including walls shall be in conduit or enclosed raceway.
  4. Penetrations of floor slabs shall be by core drilling. All penetrations shall be plumb, true, and square.
- E. BAS Identification Standards
1. Node Identification. All nodes shall be identified by a permanent label fastened to the enclosure. Labels shall be suitable for the node location.  
Cable types specified in Item A shall be color coded for easy identification and troubleshooting.
- F. BAS Panel Installation
1. The BAS panels and cabinets shall be located as indicated at an elevation of not less than 2 feet from the bottom edge of the panel to the finished floor. Each cabinet shall be anchored per the manufacturer's recommendations.
  2. The BAS contractor shall be responsible for coordinating panel locations with other trades and electrical and mechanical contractors.
- G. Input Devices
1. All Input devices shall be installed per the manufacturer recommendation
  2. Locate components of the BAS in accessible local control panels wherever possible.
- H. HVAC Input Devices – General
1. All Input devices shall be installed per the manufacturer recommendation
  2. Locate components of the BAS in accessible local control panels wherever possible.
  3. The mechanical contractor shall install all in-line devices such as temperature wells, pressure taps, airflow stations, etc.
  4. Input Flow Measuring Devices shall be installed in strict compliance with ASME guidelines affecting non-standard approach conditions.
  5. Outside Air Sensors
    - a. Sensors shall be mounted on the North wall to minimize solar radiant heat impact or located in a continuous intake flow adequate to monitor outside air conditions accurately.
    - b. Sensors shall be installed with a rain proof, perforated cover.
  6. Medium to High Differential Water Pressure Applications (Over 21" w.c.):
    - a. Air bleed units, bypass valves and compression fittings shall be provided.
  7. Building Differential Air Pressure Applications (-1" to +1" w.c.):

- a. Transmitters exterior sensing tip shall be installed with a shielded static air probe to reduce pressure fluctuations caused by wind.
  - b. The interior tip shall be inconspicuous and located as shown on the drawings.
- 8. Duct Temperature Sensors:
  - a. Duct mount sensors shall mount in an electrical box through a hole in the duct and be positioned so as to be easily accessible for repair or replacement.
  - b. The sensors shall be insertion type and constructed as a complete assembly including lock nut and mounting plate.
  - c. For ductwork greater in any dimension than 48 inches or where air temperature stratification exists such as a mixed air plenum, utilize an averaging sensor.
  - d. The sensor shall be mounted to suitable supports using factory approved element holders.
- 9. Space Sensors:
  - a. Shall be mounted per ADA requirements.
  - b. Provide lockable tamper-proof covers in public areas and/or where indicated on the plans.
- 10. Low Temperature Limit Switches:
  - a. Install on the discharge side of the first water or steam coil in the air stream.
  - b. Mount element horizontally across duct in a serpentine pattern insuring each square foot of coil is protected by 1 foot of sensor.
  - c. For large duct areas where the sensing element does not provide full coverage of the air stream, provide additional switches as required to provide full protection of the air stream.
- 11. Air Differential Pressure Status Switches:
  - a. Install with static pressure tips, tubing, fittings, and air filter.
- I. HVAC Output Devices
  - 1. All output devices shall be installed per the manufacturers recommendation. The mechanical contractor shall install all in-line devices such as control valves, dampers, airflow stations, pressure wells, etc.
  - 2. Actuators: All control actuators shall be sized capable of closing against the maximum system shut-off pressure. The actuator shall modulate in a smooth fashion through the entire stroke.
  - 3. Control Dampers: Shall be opposed blade for modulating control of airflow. Parallel blade dampers shall be installed for two position applications.
  - 4. Electronic Signal Isolation Transducers: Whenever an analog output signal from the Building Automation System is to be connected to an external control system as an input (such as a chiller control panel), or is to receive as an input a signal from a remote system, provide a signal isolation transducer. Signal isolation transducer shall provide ground plane isolation between systems. Signals shall provide optical isolation between systems

### 3.3 Training

- A. The BAS contractor shall provide the following training services:
  - 1. A minimum of one and a half days (12 hours total) of on-site orientation by a system technician who is fully knowledgeable of the specific installation details of the project. This orientation shall, at a minimum, consist of a review of the project

as-built drawings, the BAS software layout and naming conventions, and a walk through of the facility to identify panel and device locations.

2. Operational training of the BAS shall include at a minimum: changing set points, overrides, starting and stopping equipment, log in to field controllers when the server or PC is down. The BAS contractor shall be required to develop a training outline for this procedure. The training outline, including the lesson plans and course materials, shall be reviewed and approved by the engineer of record through the submittal process.

### 3.4 Sequence of Operations

- A. Refer to the drawings for the Sequence of Operations.

## ATTACHMENT I

### DMZ SECURITY STANDARD

- 1.0 Purpose - The purpose of this document is to establish requirements that will better manage and secure all platforms within the Orange County Government Board of County Commissioners (OCGBCC). The DMZ is a secure environment with limited access to the OCGBCC internal network.
- 2.0 Scope - The scope of this document applies to all platforms located within the OCGBCC DMZ.
- 3.0 Policies
  - 3.1 Activity - Any and all activity within and through the OCGBCC DMZ shall require direct involvement and documented approval by the Information Systems and Service Enterprise Security unit (ISS-ESU).
  - 3.2 Web Servers - All internal ISS-ESU policies apply to the OCGBCC DMZ and are augmented by the DMZ Security Standard. The following differences are noted:
    - 3.2.1 Microsoft Internet Information Server (IIS) version 5.0 or higher shall be the only platform within the OCGBCC DMZ to run as a Web or FTP server.
    - 3.2.2 All platforms within the OCGBCC DMZ shall be patched immediately upon the release and testing by the ISS-ESU.
  - 3.3 Administrative Rights - ISS-ESU shall be the only group with administrative rights to servers in the DMZ.
  - 3.4 Production Servers - The OCGBCC DMZ shall host production servers only.
  - 3.5 Remote Access - Remote Access to the OCGBCC DMZ shall be allowed only using Microsoft Terminal Services or Microsoft Remote Desktop protocols.
  - 3.6 Traffic
    - 3.6.1 Internet Activity - HTTP/HTTPS/FTP/SMTP/IMAPS are the only protocols allowed from the Internet into the DMZ.
    - 3.6.2 Internal Activity - Traffic using the following protocols from the DMZ to the internal network shall not be allowed: Kerberos, NetBIOS, Microsoft-DS, Microsoft's Well Known Ports (88, 135, 137, 138, 139, 389, 445, 464, 530, 543, 544, 636, 749, 3389), LDAP, RPC, SMB, RDP, HTTP, HTTPS, DNS, JOLT.
    - 3.6.3 Routing
      - 3.6.3.1 All approved access from the DMZ to the internal network shall be routed through a proxy server residing in the DMZ.
      - 3.6.3.2 The Enterprise DMZ proxy server shall only use firewall conduits to access approved resources within the OCGBCC network.
  - 3.7 Data
    - 3.7.1 Any data accessible within the OCGBCC DMZ or directly accessible from it should be encrypted.
    - 3.7.2 Any data accessible within the OCGBCC DMZ or directly accessible from it meeting the following criteria shall be encrypted: Name, addresses, phone numbers, email addresses, birthdates, federal/state/local document numbers,



account numbers, race or religious information, employee identification numbers and all HIPAA information.

- 3.7.3 The OCGBCC DMZ shall not have access to data containing bank information.
- 3.7.4 The OCGBCC DMZ shall not have access to social security information.
- 3.7.5 The OCGBCC DMZ shall have read only access to live data, if such data is also used by applications residing in the internal OCGBCC network.

#### 4.0 Guidelines

- 4.1 Should databases in policy 3.7.4 need to receive updates by the OCGBCC DMZ, the write operations should be made to a physically separate “staging” data repository. This separate data repository should contain only updates for the specific records being changed. An application server within the internal network should be used to apply the changes in the staging data repository to the live database.
- 4.2 The DMZ should access data repositories in the internal OCGBCC network using SQL database calls.

5.0 Enforcement - Any server found within the OCGBCC DMZ that does not meet the above criteria shall be immediately disconnected from the OCGBCC DMZ. Any employee found to have violated this policy may be subject to disciplinary action, up to and including termination of employment.

#### 6.0 Definitions

<u>Term</u>	<u>Definition</u>
Bank Information	Checking account numbers, credit card numbers, or any unique number from a bank institution.
HTTP	HyperText Transfer Protocol – The underlying protocol used by the World Wide Web. HTTP defines how messages are formatted and transmitted, and what actions web servers and browsers should take in response to various commands.
HTTPS	HyperText Transfer Protocol over Secure Socket Layer (SSL) – By convention, URLs that require an SSL connection start with https: instead of just http:.
FTP	File Transfer Protocol – The protocol for exchanging files over the Internet. FTP works in the same way as HTTP for transferring web pages from a server to a user's browser and SMTP for transferring electronic mail across the Internet in that, like these technologies, FTP uses the Internet's TCP/IP protocols to enable data transfer. FTP is most commonly used to download a file from a server using the Internet or to upload a file to a server.
SMTP	Simple Mail Transfer Protocol – A protocol for sending e-mail messages between servers. In addition, SMTP is generally used to send messages from a mail client to a mail server.
IMAPS	Internet Message Access Protocol – A protocol for retrieving e-mail messages. With IMAP4, you can search through your e-mail messages for keywords while the messages are still on mail server and, then, choose which messages to download to your machine.
LDAP	Lightweight Directory Access Protocol – A set of protocols for accessing information directories.

- DNS Domain Name System (or Service or Server) – An Internet service that translates domain names into IP addresses. Because domain names are alphabetic, they're easier to remember. The Internet however, is really based on numeric IP addresses. Every time you use a domain name, therefore, a DNS service must translate the name into the corresponding IP address.
- SQL Structured query language – SQL is a standardized query language for requesting information from a database.
- DMZ Demilitarized Zone – A computer term used for a protected network that sits between the Internet and the corporate network.
- SSL Secure Sockets Layer – A protocol for transmitting private documents via the Internet. SSL uses a cryptographic system that uses two keys to encrypt data - a public key known to everyone and a private or secret key known only to the recipient of the message.

ATTACHMENT II  
ENCRYPTION AND CERTIFICATION AUTHORITIES

- 1.0 Purpose - The purpose of this document is to ensure that all Orange County Government Board of County Commissioner's (OCGBCC) sensitive data is secured by using strong encryption algorithms that have received substantial public review and have been proven to work effectively. Orange County Information Systems and Services Enterprise Security unit (ISS-ESU) provides access to a variety of Encryption Services and Enterprise Certification Authorities (CA).
- 2.0 Scope - This document applies to all data transmitted and stored within the OCGBCC information systems. It applies to all OCGBCC employees, consultants, and all other affiliated third parties operating within the OCGBCC information systems and networks.
- 3.0 Policies
- 3.1 Activity
- 3.1.1 Any and all activity within and through the OCGBCC information systems involving encryption shall require direct involvement and documented approval by the Information Systems and Service Enterprise Security unit (ISS-ESU).
- 3.1.2 The ISS-ESU shall approve the storage and transfer of any data containing personal information and/or residing in the DMZ.
- 3.2 Encryption Algorithms
- 3.2.1 One of the following standard encryption ciphers shall be used to encrypt data. The key length for these algorithms shall be no less than 128bits:
- Triple-DES (3DES)
  - Rijndael (AES)
  - RSA
  - Blowfish
  - Twofish
  - CAST
- 3.2.2 PGP is an approved encryption standard provided that the PGP private key used to encrypt and /or sign data has been generated using a cipher meeting the requirements in section 3.2.1.
- 3.3 Data Hashing - The following standard data hashing algorithms shall be used to hash data. The key length for the algorithms shall be no less than 128bits.
- MD5
  - SHA-1
  - SHA-2
- 3.4 SSL Certificates - Web Server, SSH, IMAPS, SMTPS SSL certificates should have key lengths of no less than 128bits.
- 3.5 Sensitive Data - Any data containing sensitive information, including, but not limited to: name, addresses, phone numbers, email addresses, birthdates, federal/state/local document numbers, account numbers, race or religious information, employee identification numbers and all HIPAA information, should be encrypted when stored and during network transfers.
- 3.6 DMZ

- 3.6.1 Any and all activity within and through the OCGBCC DMZ shall require direct involvement and documented approval by the Information Systems and Service Enterprise Security unit (ISS-ESU).
- 3.6.2 Any data accessible within the OCGBCC DMZ or directly accessible from it should be encrypted.
- 3.6.3 Any data accessible within the OCGBCC DMZ or directly accessible from it meeting the following criteria shall be encrypted: name, addresses, phone numbers, email addresses, birthdates, federal/state/local document numbers, account numbers, race or religious information, employee identification numbers and all HIPAA information.

3.7 Data Backups

- 3.7.1 Any backup of OCGBCC should be encrypted. Sensitive data as listed in 3.5 of this document shall be backed up using encryption algorithm standards found in 3.2.

3.8 Laptops and Removal Devices

- 3.8.1 All laptop hard drives should be encrypted.
- 3.8.2 Any sensitive data (see section 3.5 of this document) stored on laptops and removable devices shall be encrypted.
- 3.8.3 All individuals who work with sensitive data (see section 3.5 of this document) shall have their laptop hard drives encrypted.

4.0 Guidelines

- 4.1 SSL certificates issued to servers and applications used by internet users should be provided by commercial CA authorities (i.e. Verisign, Thawte) to avoid security warnings from being presented to the end users.
- 4.2 SSL certificates issued to servers and applications used by internal OCGBCC resources should be issued by OCGBCC's Certification Authority.

5.0 Enforcement - Any employee found to have violated these policies may be subject to disciplinary action, up to and including termination of employment.

6.0 Definitions

<u>Term</u>	<u>Definition</u>
Encryption	Transforming understandable data into a form that is incomprehensible and that looks like random noise.
Hashing	An algorithm that takes an entire message and, through process of shuffling, manipulating, and processing the bytes using logical operations, generates a small message digest of the data.
DMZ	De-Militarized Zone – A computer term used for a protected network that sits between the Internet and the corporate network.

Certification Authority (CA) In cryptography, a certificate authority or certification authority (CA) is an entity which issues digital certificates for use by other parties.

ATTACHMENT III  
ANTIVIRUS STANDARDS

- 1.0 Purpose - The purpose of this document is to establish requirements which must be met by all computers connected to the Orange County Government Board of County Commissioners (OCGBCC) network to ensure effective virus detection and prevention.
- 2.0 Scope - This document applies to all OCGBCC computers running any version of the Microsoft Windows Operating Systems. This includes, but is not limited to, all servers, desktop computers, laptop computers, PC-based printers and appliances.
- 3.0 Policy
- 3.1 Virus Software – Servers  
Trend Micro Server Protect or Trend Micro OfficeScan shall be installed and enabled on all OCGBCC computers running any server version of the Microsoft Windows Operating Systems.
- 3.2 Virus Software – Workstations  
Trend Micro OfficeScan shall be installed and enabled on all OCGBCC computers running any non-server version of the Microsoft Windows Operating Systems.
- 3.3 Virus Software – Exchange Servers  
Trend Micro ScanMail shall be installed and enabled on all OCGBCC computers running Microsoft Exchange Server.
- 3.4 Virus Software – Internet Mail  
All incoming and outgoing internet email shall be scanned by Trend Micro Interscan Messaging Security Suite before being delivered.
- 3.5 Virus scanning  
Antivirus software shall be running at all times on the computers on which it is installed. Real-time scanning of incoming and outgoing files shall be enabled at all times. Antivirus scans of servers shall be executed on a weekly basis in accordance with the schedules set in Trend Micro Server Protect. Antivirus scans of workstations shall be executed on a weekly basis in accordance with the schedules set in Trend Micro OfficeScan.
- 4.0 Guidelines
- When employees receive unwanted and unsolicited emails, they should be deleted and should avoid replying to the sender. These messages should not be forwarded.
  - Employees should never open any files or macros attached to an email from an unknown, suspicious or untrustworthy source. These attachments should be deleted immediately. These messages should not be forwarded.
  - Employees should never download files from unknown or suspicious sources.
- 5.0 Enforcement - Trend Micro's antivirus products are installed on all servers and workstations during the initial installation of the operating systems, and are continuously monitored to ensure they are running. Any employee or temporary found to have willfully stopped and/or paused these programs will be considered to be violating these policies and may be subject to disciplinary action, up to and including termination of employment.

6.0 Definitions

<u>Term</u>	<u>Definition</u>
Virus	A program or piece of code that is loaded onto your computer without your knowledge and runs against your wishes. Viruses can also replicate themselves. All computer viruses are manmade. A simple virus that can make a copy of its self over and over again is relatively easy to produce. Even such a simple virus is dangerous because it will quickly use all available memory and

bring the system to a halt. An even more dangerous type of virus is one capable of transmitting itself across networks and bypassing security systems.

## ATTACHMENT IV

### WEB SECURITY STANDARD

- 1.0 Purpose - The purpose of this document is to establish requirements that will better manage and secure all web server platforms within the Orange County Government Board of County Commissioners (OCGBCC).
- 2.0 Scope - The scope of this document applies to all web server platforms located within the OCGBCC.
- 3.0 Policies
  - 3.1 Activity - Any and all web server installations, removals or modifications shall require the direct involvement and documented approval by the Information Systems and Service Enterprise Security unit (ISS-ESU).
  - 3.2 Hardware
    - 3.2.1 All hardware platforms operating as a web server shall abide by all standards, policies and guidelines of the OCGBCC Enterprise Systems unit.
    - 3.2.2 All hardware platforms operating as a web server shall reside on server hardware. Any exception shall require a documented wavier by the Information Systems and Services Enterprise Security unit (ISS-ESU).
  - 3.3 Software
    - 3.3.1 Web Server Platforms
      - 3.3.1.1 Microsoft - Microsoft's Internet Information Server (IIS) is the approved, supported web server platform for OCGBCC.
      - 3.3.1.2 Apache Software Foundation - Apache Software Foundation's HTTP Server (Apache) is approved but is unsupported. Any production use of (Apache) shall include an appropriate support model that is approved by the ISS-ESU.
      - 3.3.1.3 Other - Other web server platforms may qualify for use, but shall require an evaluation, approval and a documented wavier by the ISS-ESU.
    - 3.3.2 Databases
      - 3.3.2.1 Location - A database server shall not reside on the same hardware platform as a web server.
  - 3.4 Security
    - 3.4.1 General - All web servers shall comply with all other documented ISS-ESU standards to include, but not limited to: virus, patch and account management.
    - 3.4.2 Account Management
      - 3.4.2.1 Local Account Access - Only accounts with local administrator privileges shall be allowed to log on locally to a web server.
      - 3.4.2.2 Process/Application Accounts - All web server processes and applications shall run only under a low privilege local account.

Web server processes shall not run under an account with domain, power user or a local administrator privileges.

3.4.2.3 Web Server Anonymous Accounts - Web server anonymous accounts shall only have read and execute permissions to folders/files within the web server directories. Change and delete permissions to folders/files that are directly accessible via a web browser shall not be granted to web server anonymous accounts.

### 3.4.3 Permissions

3.4.3.1 Operating System Permissions - ISS-ESU shall secure the operating system's file/folder permissions and security policies of all web servers. These permissions are to be modified solely by ISS-ESU.

3.4.3.2 Vendor/Third Party Access - Local administrator privileges on web servers are for authorized personnel only. Access to vendors and any other third party shall be provided solely on a temporarily, case-by-case basis through ISS-ESU.

3.4.3.3 Developer Access - Developer access to web server content directories shall be available by WebDav or FrontPage server extensions only. Developers shall be granted "Author Pages" rights with the FrontPage Server Extensions

3.4.4 Java Server Engines - Java server engines are approved but are not supported. Any production use of a Java server engine shall include an appropriate support model that is approved by (ISS-ESU).

3.4.5 FTP - Web servers that also run an FTP server shall not map FTP directories to directories accessible via a web browser.

3.4.6 IIS Virtual Directories, Application Pools, Settings - Any and all creations, removals or modifications to IIS Settings, Virtual Directories, Application Directories, and Application Pools shall require the direct involvement and documented approval by the Information Systems and Service Enterprise Security unit (ISS-ESU).

#### 3.4.7 Other

- Shares are not allowed on any directory accessible via web browser.
- Microsoft Windows web servers and any web application shall not be installed on the same drive as the host operating system.
- Executable files (.exe, .com, .bat, .dll, etc) shall not be placed into directories accessible via a web browser without the direct involvement and documented approval by the Information Systems and Service Enterprise Security unit (ISSESU).

4.0 Guidelines - It is recommended that all web applications use the enterprise FTP and SMTP servers for all FTP/SMTP traffic.

5.0 Enforcement - Any web server not meeting the above criteria may be immediately disconnected from the OCGBCC network. Any employee found to have violated these policies may be subject to disciplinary action, up to and including termination of employment.



## 6.0 Definitions

<u>Term</u>	<u>Definition</u>
FTP	File Transfer Protocol – The protocol for exchanging files over the Internet. FTP works in the same way as HTTP for transferring Web pages from a server to a user's browser and SMTP for transferring electronic mail across the Internet in that, like these technologies, FTP uses the Internet's TCP/IP protocols to enable data transfer. FTP is most commonly used to download a file from a server using the Internet or to upload a file to a server.
WebDav	Web-based Distributed Authoring and Versioning – Extensions to HTTP that allows users to collaboratively edit and manage files on remote Web servers.
Front Page Extensions	A series of scripts that can be employed using Microsoft FrontPage, a visual HTML editor.
SMTP	Simple Mail Transfer Protocol – A protocol for sending e-mail messages between servers. In addition, SMTP is generally used to send messages from a mail client to a mail server.

## ATTACHMENT V

### STANDARDS SUMMARY

The following is a summary of key points in the Orange County Government Board of County Commissioners (OCGBCC) security standards. It is necessary for vendors to completely understand and follow these requirements in order for products or services to be considered for placement within the OCGBCC environment. Complete details about these standards can be found in the Orange County Government Standards and Guidelines packet.

#### WEB SERVERS

##### Web and Database Placement

A database server shall not reside on the same hardware platform as a web server.

##### Anonymous Accounts

Web server anonymous accounts shall only have read and execute permissions to folders/files within the web server directories. Change and delete permissions to folders/files that are directly accessible via a web browser shall not be granted to web server anonymous accounts.

#### DMZ

##### Web Server Platforms

Microsoft Internet Information Server (IIS) version 5.0 or higher shall be the only platform within the OCGBCC DMZ to run as a Web or FTP server.

##### Services and Protocols

Traffic using the following protocols from the OCGBCC DMZ to the internal network shall not be allowed: Kerberos, NetBIOS, Microsoft-DS, Microsoft's Well Known Ports, LDAP, RPC, SMB, RDP, HTTP, HTTPS, DNS, JOLT.

##### Encrypted Data

Any data accessible within the OCGBCC DMZ or directly accessible from it meeting the following criteria shall be encrypted: Name, addresses, phone numbers, email addresses, birthdates, federal/state/local document numbers, account numbers, race or religious information, employee identification numbers and all HIPAA information. The OCGBCC DMZ shall not have access to data containing bank information. The OCGBCC DMZ shall not have access to social security information.

##### Data Access

The OCGBCC DMZ shall have read only access to live data, if such data is also used by applications residing in the internal OCGBCC network.

#### ANTIVIRUS

##### Virus scanning

Antivirus software shall be running at all times on the computers on which it is installed.

#### MICROSOFT SECURITY PATCHES

##### Patch Installation

MS Security patches may be applied immediately upon release by Microsoft. All vendors must support their applications in this environment.

## ATTACHMENT VI

### DESKTOP COMPUTING STANDARDS

#### AUTHORIZED PRODUCTS

##### 1: HARDWARE

###### Dell Desktop minitower and small form factor (SFF) PC

- ◆ Dell GX960
  - ◆ Energy Smart system enabled
  - ◆ Intel Core 2 Duo processor or better
  - ◆ Minimum 2 Gb of Memory
  - ◆ Maximum 4 Gb Memory
  - ◆ USB Keyboard and Mouse
  - ◆ 160 GB SATA Hard drive
  - ◆ DVD+/- RW
  - ◆ 4 Year Basic Limited Warranty and 4 year Onsite Service
  - ◆ Intel vPro enabled

###### Dell Laptop

- ◆ Dell Latitude e6510
  - ◆ Intel Core 2 Duo processor or better
  - ◆ Minimum 2 Gb of Memory
  - ◆ Maximum 4 Gb of memory
  - ◆ CD-RW/DVD
  - ◆ 80 GB Hard Drive
  - ◆ 4 Year Limited Warranty and 4 year Onsite Service
  - ◆ Intel vPro enabled
- ◆ Dell Latitude e4300
  - ◆ Intel Centrino Core 2 Duo processor
  - ◆ Minimum 2 Gb memory
  - ◆ Maximum 4 Gb memory
  - ◆ CD-RW/DVD
  - ◆ 80 Gb Hard Drive
  - ◆ 4 Year Limited Warranty
  - ◆ Intel vPro enabled
    - *All PCs with 4yr limited warranty*
- ◆ PDAs- Blackberry Devices Only

##### 2: OPERATING SYSTEMS and PROTOCOLS

###### Desktop/Laptop

- ◆ Microsoft Windows 7 Professional with IE 8 (for new PCs)
- ◆ Microsoft Windows XP Service Pack 3 (for existing PCs)
- ◆ Internet Explorer 8.0- *IE8 is current County Standard included with Windows 7. IE7 is available for backwards compatibility.*
  - ◆ *Application software may specifically require a certain Internet Explorer version. Contact ISS for assistance as needed. [ServiceCenter@ocfl.net](mailto:ServiceCenter@ocfl.net)*
- ◆ Microsoft Office 2003 or greater (Standard or Professional Suite)

###### Portable Devices

- ◆ Blackberry OS

###### Network Connectivity

- ◆ Cisco Wireless Access Points, Cisco 802.11 LAN Card
- ◆ TCP/IP

- ◆ Sprint Wireless AirCard

3: CLIENT DATABASES

Desktop/Workstations Only, Single User Only

- ◆ Microsoft Access (user databases not supported)
- ◆ Oracle Client
- ◆ SQL Server Client

4: PERIPHERALS and ACCESSORIES

- ◆ HP LaserJet series
  - ◆ Black and White LaserJet
    - ◆ P1606dn < 4 users
    - ◆ P3015dn (supports secure printing – PIN)
    - ◆ P4015dn 8+ users (supports secure printing – PIN)
  - ◆ Color LaserJet
    - ◆ CP2025dn
    - ◆ CP4525dn 7+ users (supports secure printing – PIN)
    - ◆ 5550dn 15+ users (supports secure printing – PIN)
- ◆ *Desktop Copier and combo unit purchases directly connected to the PC must be reviewed and approved by ISS. Contact [ServiceCenter@ocfl.net](mailto:ServiceCenter@ocfl.net) for more information and assistance.*

UNSUPPORTED PRODUCTS

1: HARDWARE

- ◆ Pre-Pentium class desktop systems
- ◆ Non-Dell PCs
- ◆ Non-Blackberry Smartphones

2: OPERATING SYSTEMS AND PROTOCOLS

- ◆ Microsoft Windows 2000
- ◆ Microsoft Windows NT 4.0
- ◆ Microsoft Windows 3.x, Windows 95 and 98
- ◆ MAC OS

3: CLIENT DATABASES

- ◆ Dbase
- ◆ RBASE
- ◆ Paradox
- ◆ FOXPRO

4: DESKTOP APPLICATIONS

Desktop/Workstation

- ◆ MS Office platforms prior to Office 2000
- ◆ ProComm
- ◆ Microsoft Internet Explorer, 4.x, 5.x
- ◆ McAfee Viruscan *\*Trend Micro is OCGOV standard*
- ◆ WordPerfect
- ◆ Quattro
- ◆ Hotmetal
- ◆ Freelance
- ◆ Harvard Graphics
- ◆ Lotus Suite
- ◆ Netscape, Opera, Firefox Browsers

- ◆ Rumba
- ◆ LAN Workplace
- ◆ Exceed
- ◆ Visio 3.x and older
- ◆ SHL Vision & Vision Express, WIN9x/WINNT/UNIX
- ◆ McAfee Remote Desktop32
- ◆ Reflection version 9 or lower
- ◆ PC Anywhere

5: PERIPHERALS AND ACCESSORIES

- ◆ HP LaserJet Series 4 and older printers
- ◆ Inkjet printers

PROHIBITED PRODUCTS

1: HARDWARE

- ◆ Personal (non-County) PCs
- ◆ Any network (voice or data) device not operated, administered or expressly approved by Orange County ISS.
- ◆ Any internet access device not operated, administered or expressly approved by Orange County ISS.

2: OPERATING SYSTEM AND PROTOCOLS

- ◆ Windows 9x
- ◆ Windows Vista
- ◆ 64 bit operating systems

Network Protocols

- ◆ NETBUI
- ◆ AppleTalk
- ◆ Token Ring
- ◆ Any network (voice or data) software or service not operated, administered or expressly approved by Orange County ISS.
- ◆ Any internet access service not operated, administered or expressly approved by Orange County ISS.

3: APPLICATIONS

- ◆ Any Alpha/Beta Software not operated, administered or expressly approved by Orange County ISS
- ◆ Anti-virus products other than Trend Micro
- ◆ Personal firewall products
- ◆ Network scanning tools
- ◆ Remote access software other than ISS authorized VPN
- ◆ User installed screen savers
- ◆ Games
- ◆ 3<sup>rd</sup> Party Desktops
- ◆ Disk Compression
- ◆ Non-Static BITMAP Backgrounds or screen savers
- ◆ iTunes (or other content sharing applications)
- ◆ P2P software

4: PERIPHERALS AND ACCESSORIES

- ◆ Portable music devices
- ◆ Personal (non-County) mass storage devices (hard drives, thumb drives, etc)
- ◆ Webcams

SECTION 15950 - SEQUENCE OF OPERATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Provisions of Section 15010, Mechanical General Provisions, shall be made an integral part of this section.

1.2 WORK INCLUDED

- A. Provide all labor, material, documentation and services required for the implementation of the Sequences of Operation detailed herein.

1.3 RELATED WORK

- A. Section 15900 – Building Automation Systems

1.4 APPLICABLE PROVISION

- A. Were modulation of a valve or damper is referred to then it shall mean the direct digital control of the valve or damper based on a control algorithm resident in the BCS software at the remote field panel. Unless noted otherwise the control algorithm shall be PID control. Optimum loop response shall be ensured by the use of a built in automatic loop tuner.
- B. An Operator having the required level of password access shall be able to modify the Operator changeable or definable parameter(s) on-line from an I/O device such that the monitoring and control functions of the BCS shall not be affected during the period of the change. The mechanism by which the change is made shall be simple and shall be adequately described in the Operator's manuals. Where setpoints for control parameters such as setpoint or changeover temperatures, humidities, or times are referred to in this Section they shall be Operator changeable on-line.
- C. Where the sequences refer to the start/stop of a system this shall be initiated either by an Operator manually entered command or automatically by a software routine such as "Optimum Stop/Start", "Power Demand Control", "Programmed Stop/Start", etc. or via an interlock in the sequences of operation to other equipment or event(s).
- D. Refer to the Point Definition Sheets and System Schematics, which form part of these Contract Documents, to facilitate the interpretation of the sequences of operation as defined herein.
- E. Provide additional I/O points, whether or not such points are indicated in the Point Definition Sheets, if they are required in order to attain the requirements of the Contract Documents.
- F. The point list is provided for convenience and is not intended to be all-inclusive. All points required to provide the Sequence of Operation shall be included as if listed.
- G. All wiring required to provide the Sequence of Operation shall be included.

1.5 ABBREVIATIONS

AFD	Adjustable Frequency Drive
AUX	Starter Auxiliary Contact
AI	Analog Input
AO	Analog Output
CFM	Air Flow in CFM from Air Monitor
CSR	Current Sensing Relay
D	Damper Operation
DI	Digital Input
DO	Digital Output
DP	Differential Pressure
ES	End Switch
Fa	Failure Alarm
FR	Freezestat
FS	Flow Switch
H	Humidity Sensor
Ha	High Static Pressure Alarm
IAQ	Indoor Air Quality
IGV	Inlet Guide Vanes
La	Low Static Pressure Alarm
Ma	Maintenance Alarm
Pd	Discharge Static Pressure
Pdd	Downduct Static Pressure
Pds	Discharge Static Pressure Safety
Ps	Suction Static Pressure
Pss	Suction Static Pressure Safety
R	Relay
Sa	Safety Alarm/Shut-down
SD	Smoke Detector
DP	Static Pressure Sensor
SR	Damper Smoke Rated
SS	Start-Stop
T	Temperature Sensor
Ta	Temperature Alarm
V	Valve Operator
VP	Virtual Point
X	Hardwired Item

1.6 SUBMITTALS:

- A. Submission for acceptance is required.
- B. Product data, along with installation operation and maintenance instructions, shall be included in the operation and maintenance manuals.

PART 2 – PRODUCTS (Not Applicable)

PART 3 – EXECUTION

3.1 SEQUENCE OF OPERATION – Refer to Construction Documents.

END OF SECTION 15950

SECTION 16010 - BASIC ELECTRICAL REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes Basic Electrical Requirements specifically applicable to Division 16 Sections, in addition to Division 1 - General Requirements - and any supplemental requirements/conditions.

1.3 DESCRIPTION OF WORK

- A. The work required under this Division shall include all materials, labor and auxiliaries required to install a complete and properly operating electrical system.
- B. The Contractor shall furnish, perform, or provide all labor including planning, purchasing, transporting, storing, installing, testing, cutting and patching, trenching, excavating, backfilling, coordination, field verification, equipment (installation and safety), supplies, and materials necessary for the correct installation of complete electrical systems (as described or implied by these specifications and the applicable drawings) in strict accordance with applicable codes, which may not be repeated in these specifications, but are expected to be common knowledge of qualified Bidders.
- C. The Division 16 Contract Documents refer to work required in addition to (or above) the minimum requirements of the NEC and applicable local codes. All work shall comply with all applicable codes as a minimum and with the additional requirements called for in these Contract Documents.
- D. Only trained and qualified personnel shall be used by the Contractor to perform work. The Contractor shall not perform work which violates applicable Codes, even if called for in the Contract Documents. The Contractor's Bid shall include work necessary to completely install the electrical systems indicated by the Contract Documents in accordance with applicable Codes.
- E. Refer to other Division 16 Sections for additional work requirements.
- F. Coordinate and verify power and telephone company service requirements prior to bid. Bid to include all work required for complete and properly operating systems..
- G. Connections of all items using electric power shall be included under this division of the specifications, including necessary wire, conduit, circuit protection, disconnects and accessories. Securing of roughing-in drawings and connection information for equipment involved shall also be included under this division. See other divisions for specifications for electrically operated equipment.
- H. The Contractor shall provide and install panic hardware on all electrical room doors where the electrical room houses equipment rated 1200 amps or more per NEC 110.26. All electrical room doors shall open in the direction of egress.

1.4 WORK SEQUENCE

- A. Install work in stages and/or phases to accommodate Owner's occupancy requirements. Coordinate electrical schedule and operations with Owner and Architect/Engineer.

1.5 CODES, FEES, AND STANDARDS

- A. Conform to all applicable requirements of Section 16014 Reference Standards and Regulatory Requirements.



- B. Obtain permits and request inspections from Authority Having Jurisdiction and applicable utility companies.
- C. Pay for all required licenses, fees, and inspections.
- D. Contact the utility companies to determine if fees, charges or costs are required by the utility company for permanent power and for temporary power, installations and hook-ups. These fees, charges or costs shall be included in Contractor's bid.
- E. Material shall be new and free of defects with UL listing or be listed with an approved, nationally recognized Electrical Testing Agency if and only if UL listing is not available for material.

#### 1.6 PROJECT/SITE CONDITIONS

- A. Install work in locations shown or described in the Contract Documents, unless prevented by Project conditions.
- B. The Contractor shall install all equipment so that all Code required and manufacturer recommended servicing clearances are maintained. Contractor shall be responsible for the proper arrangement and installation of all equipment within any designated space. Should the Contractor determine that a departure from the Contract Documents is necessary, he shall submit to the A/E, for approval, detailed drawings of his proposed changes with his written reasons for the changes. No changes shall be implemented by the Contractor without the issuance of the required drawings, clarifications, and/or change orders.
- C. The Contractor shall verify finish dimensions at the project site in preference to using dimensions noted on Contract Documents.

#### 1.7 INVESTIGATION OF SITE

- A. Check site and existing conditions thoroughly before bidding. Advise A/E of discrepancies or questions noted.
- B. Each Bidder shall visit the site and shall thoroughly familiarize himself with existing field conditions and the proposed work as described or implied by the Contract Documents. During the course of the site visit, the electrical bidder shall verify every aspect of the proposed work and the existing field conditions in the areas of construction which will affect his work. The Contractor will receive no compensation or reimbursement for additional expenses he incurs due to failure to make a thorough investigation of the Site. This shall include rerouting around existing obstructions.
- C. 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. Contractor shall 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.
- D. The Contractor shall locate all existing utilities and protect them from damage. The Contractor shall pay for repair or replacement of utilities or other property damaged by operations in conjunction with the completion of this work.

#### 1.8 CONTRACT DOCUMENTS

- A. These specifications and applicable drawings shall be considered supplementary, one to the other and are considered Contract Documents. All workmanship, methods, and/or material described or implied by one and not described or implied by the other shall be furnished, performed, or otherwise provided just as if it had appeared in both sets of documents.
- B. Where a discrepancy or conflict is found between these specifications and any applicable drawing, the Contractor shall notify the A/E in written form. In the event that a discrepancy exists

between specifications and any applicable drawing, the most stringent requirement shall govern unless the discrepancy conflicts with applicable codes wherein the code shall govern. The most stringent requirement shall be that work, product, etc which is the most expensive and costly to implement.

- C. The drawings are diagrammatic and are not intended to include every detail of construction, materials, methods, and equipment. They indicate the result to be achieved by an assemblage of various systems. Coordinate equipment locations with Architectural and Structural drawings. Layout equipment before installation so that all trades may install equipment in spaces available. Coordinate installation in a neat and workmanlike manner.
- D. Wiring arrangements for equipment shown on the drawings are intended to be diagrammatic and do not show all required conductors and functional connections. All wiring and appurtenances required for the proper operation of all equipment to be connected shall be provided.
- E. Specifications require the Contractor to provide shop drawings which shall indicate the fabrication, assembly, installation, and erection of a particular system's components. Drawings that are part of the Contract Documents shall not be considered a substitute for required shop drawings, field installation drawings, Code requirements, or applicable standards.
- F. Locations indicated for outlets, switches, and equipment are approximate and shall be verified by instructions in specifications and notes on the drawings. Where instructions or notes are insufficient to locate the item, notify the A/E.
- G. The Contractor shall take finish dimensions at the project site in preference to scaling dimensions on the drawings.
- H. Where the requirements of another division, section, or part of these specifications exceed the requirements of this division those requirements shall govern.

#### 1.9 MATERIALS AND EQUIPMENT

- A. Material shall be new (except where specifically noted, shown or specified as "Reused") and/or denoted as existing) and shall be UL listed and bear UL label. Where no UL label listing is available for a particular product, material shall be listed with an approved, nationally recognized Electrical Testing Agency. Where no labeling or listing service is available for certain types of equipment, test data shall be submitted to prove to the Engineer that equipment meets or exceeds available standards.
- B. Where Contract Documents list design selection or manufacturer, type, this model shall set the standard of quality and performance required. Where no brand name is specified, the source and quality shall be subject to A/E's review and acceptance. Where Contract Documents list accepted substitutions, these items shall comply with Division 1 requirements and Section 16013 Substitutions.
- C. When a product is specified to be in accordance with a trade association or government standard and at the request of A/E the Contractor shall furnish a certificate that the product complies with the referenced standard and supporting test data to substantiate compliance.
- D. Where multiple items of the same equipment or materials are required, they shall be the product of a single manufacturer.
- E. Where the Contract Documents require materials and/or equipment installed, pulled, or otherwise worked on, the materials and/or equipment shall be furnished and installed by the Contractor responsible for Division 16 methods and materials unless specifically noted otherwise.
- F. Where the contract documents refer to the terms "furnish," "install," or "provide," or any combination of these terms) the materials and/or equipment shall be supplied and delivered to the project including all labor, unloading, unpacking, assembly, erection, anchoring, protecting supplies and materials necessary for the correct installation of complete system unless

specifically noted otherwise.

- G. Before the Contractor orders equipment, the physical size of specified equipment shall be checked to fit spaces allotted on the drawings, with NEC working clearances provided. Internal access for proposed equipment substitutions shall be provided.
- H. Electrical equipment shall be protected from the weather during shipment, storage, and construction per manufacturer's recommendations for storage and protection. Should any apparatus be subjected to possible damage by water, it shall be thoroughly dried and put through a dielectric test, at the expense of the Contractor, to ascertain the suitability of the apparatus, or it shall be replaced without additional cost to the Owner. No additional time will be allowed and the project completion date shall be maintained.
- I. Inspect all electrical equipment and materials prior to installation. Damaged equipment and materials shall not be installed or placed in service. Replace or repair and test damaged equipment in compliance with industry standards at no additional cost to the Owner. Equipment required for the test shall be provided by the Contractor with no additional cost to the Contract.
- J. Material and equipment shall be provided complete and shall function up to the specified capacity/function. Should any material and/or equipment as a part or as a whole fail to meet performance requirements, replacements shall be made to bring performance up to specified requirements. Damages to finish by such replacements, alterations, or repairs shall be restored to prior conditions, at no additional cost to the Owner.
- K. Where the Contract Documents denote equipment and/or material to be 'new' and/or 'existing' and also provide no denotation for other equipment as to it being 'new' and/or 'existing,' this is not to infer that the non-denoted equipment is either new or existing, or opposite of the equipment that is denoted. The use of the terms 'new' or 'existing' is meant to clarify denoted equipment/materials for that item only, and the lack of the terms 'new' or 'existing' in relation to identifiers/notes/denotations on the drawings is not to infer that this non-denoted equipment or materials is new or existing.

#### 1.10 MISCELLANEOUS CIRCUITS REQUIRED

- A. Provide 120 volt, 20 amp circuit to post indicator valves (whether shown on drawings or not). Connect to spare 20 amp, 1 pole circuit breaker in nearest 120 volt panel. Re-label circuit breaker accordingly. Provide locking device on breaker. Coordinate location with civil engineer (and drawings/specifications) or fire protection engineer (and drawings/specifications) prior to bid and provide all required electrical. Coordinate final location and electrical requirements with valve installer after bid and provide all required electrical. Nearest panel to be nearest emergency panel, when building has emergency generator system.
- B. Provide 120 volt, 20 amp circuit to fire protection system panel and bell (whether shown on drawings or not). Connect to spare 20 amp, 1 pole circuit breaker in nearest 120 volt panel. Re-label circuit breaker accordingly. Provide locking device on breaker. Coordinate location with civil engineer (and drawings/specifications) or fire protection engineer (and drawings/specifications) prior to bid and provide all electrical. Coordinate final location and electrical requirements with panel installer after bid and provide all electrical. Nearest panel to be nearest emergency panel, when building has emergency generator system.
- C. Provide 120 volt, 20 amp circuit to intercom system panel (whether shown on drawings or not). Connect to spare 20 amp, 1 pole circuit breaker in nearest 120 volt panel. Re-label circuit breaker accordingly. Provide locking device on breaker. Coordinate location with intercom system engineer (and drawings/specifications) prior to bid and provide all electrical. Coordinate final location and electrical requirements with panel installer after bid and provide all electrical. Nearest panel to be nearest emergency panel, when building has emergency generator system.
- D. Provide 120 volt, 20 amp circuit to all fire alarm panels, remote panels, etc (whether shown on drawings or not). Connect to spare 20 amp, 1 pole circuit breaker in nearest 120 volt panel. Re-

label circuit breaker accordingly. Provide locking device on breaker. Coordinate location with fire alarm system engineer (and drawings/specifications) prior to bid and provide all electrical. Coordinate final location and electrical requirements with panel installer after bid and provide all electrical. Nearest panel to be nearest emergency panel, when building has emergency generator system.

- E. Provide 120 volt, 20 amp circuit to fire and smoke dampers (whether shown on drawings or not). Connect to spare 20 amp, 1 pole circuit breaker in nearest 120 volt panel. Re-label circuit breaker accordingly. Provide locking device on breaker. Coordinate location with fire protection engineer (and drawings/specifications) prior to bid and provide all electrical. Coordinate final location and electrical requirements with damper installer after bid and provide all electrical. Nearest panel to be nearest emergency panel, when building has emergency generator system.
- F. Provide 120 volt, 20 amp circuit to building control panels for HVAC system (whether shown on drawings or not). Connect to spare 20 amp, 1 pole circuit breaker in nearest 120 volt panel. Re-label circuit breaker accordingly. Provide locking device on breaker. Coordinate location with fire protection engineer (and drawings/specifications) prior to bid and provide all electrical. Coordinate final location and electrical requirements with damper installer after bid and provide all electrical

#### 1.11 SMOKE ALARMS

- A. Provide single and multiple station smoke alarms, whether shown on drawings or not, at locations required by Florida Building Code Chapter 9. Smoke alarms shall be hard wired to the building electrical system and receive primary power from the building 120 volt electrical system. Smoke alarms shall have battery backup. Smoke alarms shall be interconnected so that when one device detects smoke all devices within an individual dwelling unit sound alarm. Provide strobe lights in all spaces intended for the hearing impaired or where required by Federal and/or State regulations.

#### 1.12 SUPERVISION OF THE WORK

- A. Reference the General Conditions for additional requirements.
- B. The Contractor shall provide experienced, qualified, and responsible supervision for work. A competent foreman shall be in charge of the work in progress at all times. If, in the judgement of the A/E, the foreman is not performing his duties satisfactorily, the Contractor shall immediately replace him upon receipt of a letter of request from the A/E. Once a satisfactory foreman has been assigned to the work, he shall not be withdrawn by the Contractor without the written consent of the A/E.
- C. Provide field superintendent who has had a minimum of four (4) years previous successful experience on projects of comparable size and complexity. Superintendent shall be on the site at all times during construction and must have, as a minimum, an active Journeyman's Electrical License in the State of Florida.
- D. Superintendent shall be employed by a currently licensed Florida Certified Electrical Contractor (EC) or a currently licensed Florida Registered Electrical Contractor (ER).

#### 1.13 COORDINATION

- A. Provide all required coordination and supervision where work connects to or is affected by work of other trades, and comply with all requirements affecting this Division. Work required under other divisions, specifications or drawings to be performed by this Division shall be coordinated with the Contractor and such work performed at no additional cost to Owner including but not limited to electrical work required for:
  - 1. Door Hardware
  - 2. Roll-up Doors
  - 3. Fire Shutters

4. Roll-up Grilles
  5. Sliding Doors
  6. Mechanical Division of the Specifications
  7. Interior Design Drawings
  8. Landscape Architect Drawings
  9. Millwork Design Drawings and Shop Drawings
- B. Contractor shall obtain set of Contract Documents from Owner for all areas of work noted above and include all electrical work in bid whether included in Division 16 Contract Documents or not.
- C. Installation studies shall be made to coordinate the electrical work with other trades. Work shall be preplanned. Unresolved conflicts shall be referred to the A/E prior to installation of the equipment for final resolution.
- D. For locations where several elements of electrical or combined mechanical and electrical work must be sequenced and positioned with precision in order to fit into the available space, prepare coordination drawings at 1/4" scale showing the actual physical dimension required for the installation to assure proper integration of equipment with building systems and NEC required clearances. Coordination drawings shall be provided for all areas of conflict as determined by the A/E.
- E. Secure accepted shop drawings from all required disciplines and verify final electrical characteristics before roughing power feeds to any equipment. When electrical data on accepted shop drawings differs from that shown or called for in Construction Documents, make adjustments to the wiring, disconnects, and branch circuit protection to match that required for the equipment installed.
- F. Damage from interference caused by inadequate coordination shall be corrected at no additional cost to the Owner and the contract time for completion will not be extended.
- G. The Contractor shall maintain an up-to-date set of Contract Documents (Drawings and Specifications) of all trades on the project site, including Architectural, Structural, Mechanical, Electrical and, where provided Interior Design.
- H. It is the responsibility of this Contractor to coordinate the exact required location of floor outlets, floor ducts, floor stub-ups, etc. with Owner and Architect (and receive their written approval) prior to rough-in. Locations indicated in Contract Documents are approximate.
- I. The Contract Documents describe specific sizes of switches, breakers, fuses, conduits, conductors, motor starters and other items of wiring equipment. These sizes are based on specific items of power consuming equipment (heaters, lights, motors for fans, compressors, pumps, etc.). The Contractor shall coordinate the requirements of each load with each load's respective circuitry shown and with each load's requirements as noted on its nameplate data and manufacturer's published electrical criteria. The Contractor shall adjust circuit breaker, fuse, conduit, and conductor sizes to meet the actual requirements of the equipment being provided and installed and change from single point to multiple points of connection (or vice versa) to meet equipment requirements. Changes due to these coordination efforts shall be made at no additional cost to the Owner.

#### 1.14 PROVISION FOR OPENINGS

- A. Locate openings required for work. Provide sleeves, guards or other accepted methods to allow passage of items installed.
- B. Coordinate with roofing Contractor on installation of electrical items which pierce roof. Roof penetrations shall not void roof warranty.

- C. Where work pierces waterproofing, it shall maintain the integrity of the waterproofing. Coordinate roofing materials which pierce roof for compatibility with membrane or other roof types with Contractor prior to installation.

#### 1.15 CONCRETE PADS

- A. Furnish and install reinforced concrete housekeeping pads for transformers, switchgear, motor control centers, and other free-standing equipment. Unless otherwise noted, pads shall be four (4) inches high and shall exceed dimensions of equipment being set on them, including future sections, by six (6) inches each side, except when equipment is flush against a wall where the side against the wall shall be flush with the equipment. Pads shall be reinforced with W1.4 x 1.4 6 x 6 welded wire mesh. Chamfer top edges 1/2". Trowel all surfaces smooth. Provide 3000 psi concrete.
- B. Contractor to provide/install concrete pad for exterior pad mount transformers as required by power company.
- C. Contractor to provide/install concrete pad for exterior generators as recommended by generator manufacturer and structural engineer (8" minimum).

#### 1.16 SURFACE MOUNTED EQUIPMENT

- A. Surface mounted fixtures, outlets, cabinets, conduit, panels, etc. shall have factory applied finish and/or shall be painted as directed by Engineer. Paint shall be in accordance with other applicable sections of the specifications for this project.

#### 1.17 CUTTING AND PATCHING

- A. New Construction:
  - 1. Reference Division 1 - General Requirements.
  - 2. Cutting of work in place shall be cut, drilled, patched and refinished by trade responsible for initial installation.
  - 3. The Contractor shall be responsible for backfilling and matching new grades with adjacent undisturbed finished surface.

#### 1.18 TRENCHING

- A. All trench excavations in excess of 5 feet deep shall comply with OSHA Standard 29 CFRs 1926.650 Subpart P.
- B. Trench excavation in excess of 5 feet deep shall comply with OSHA Standard 29 CFRs 1926.650 Subpart P. Contractor shall complete form as referenced in Section 00100 - Instructions to Bidders.

#### 1.19 INSTALLATION

- A. Erect equipment to minimize interferences and delays in execution of the work.
- B. Take care in erection and installation of equipment and materials to avoid marring finishes or surfaces. Any damage shall be repaired or replaced as determined by the A/E at no additional cost to the Owner.
- C. Equipment requiring electrical service shall not be energized or placed in service until A/E is notified and is present or have waived their right to be present in writing. Where equipment to be placed in service involves service or connection from another Contractor or the Owner, the Contractor shall notify the Owner in writing when the equipment will be ready. The Owner shall be notified as far in advance as possible of the date the various items of equipment will be complete.
- D. Equipment supports shall be secured and supported from structural members except as field

accepted by the A/E in writing.

- E. Plywood material shall not be used as a backboard for mounting panel boards, disconnects, motor starters, and dry type transformers. Provide "cast in place" type inserts or install expansion type anchor bolts. Electrical equipment shall not be mounted directly to dry wall for support without additional channels as anchors. Channels shall be anchored to the floor and structure above. Panelboards and terminal cabinets shall be provided with structural framing located within drywall partitions.
- F. The Contractor shall keep the construction site clean of waste materials and rubbish at all times. Upon completion of the work, the Contractor shall remove from the site all debris, waste, unused materials, equipment, etc.
- G. Inserts, pipe sleeves, supports, and anchorage of electrical equipment shall be provided. Where items are to be set or embedded in concrete or masonry, the items shall be furnished and a layout made prior to the setting or embedment thereof, so as to cause no delay to the project schedule.

#### 1.20 PROGRESS AND RECORD DRAWINGS

- A. Keep two sets of blueline prints on the job, and neatly mark up design drawings each day as components are installed. Different colored pencils shall be used to differentiate each system of electrical work. Cost of prints and this labor task shall be included under this Division. All items on Progress Drawings shall be shown in actual location installed. Change the equipment schedules to agree with items actually furnished.
- B. Prior to request for substantial completion observation, furnish a set of neatly marked prints showing "as-installed" (as-built) condition of all electrical installed under this Division of the specifications. Marked up prints are to reflect all changes in work including change orders, field directives, addenda from bid set of Contract Documents, request for information responses, etc. Marked up set of prints to show:
  - 1. All raceways 1-1/2" and above, exactly as installed.
  - 2. All site raceways exactly as installed.
  - 3. Any combining of circuits (which is only allowed by specific written permission) or change in homerun outlet box shall be made on as-builts.
  - 4. Any circuit number changes on plan shall be indicated on as-builts.
  - 5. Any panelboard schedule changes shall be indicated on as-builts and final panelboard schedules..
- C. Marked up prints as noted above are to be submitted to A/E for review.. Contractor shall review submitted "as-builts" with Engineer in the field. Contractor shall verify every aspect for accuracy.
- D. The changes and alterations shall be transferred to AutoCAD (Auto CAD Release 2007 or higher). Obtain CAD disk of the construction documents by the A/E, from the A/E. generate/update the CAD disks to include all changes, additions, etc. on the accepted marked up prints. Label each drawing "As-Built" and date. Submit as-built CAD disk and reproducible of the as-builts.
- E. After acceptance of marked up prints by A/E with all changes, additions, etc. included on accepted marked up prints, submit set prior to request for final payment and/or request for final observation.
- F. Where the Contractor has failed to produce representative "as-built" drawings in accordance with requirements specified herein, the Contractor shall reimburse Engineer all costs to produce a set of "as-built" drawings to the Architect/Owner satisfaction.

#### 1.21 OBSERVATION OF WORK REPORT

- A. Reference the General Conditions.
- B. Items noted by A/E or his representative during construction and before final acceptance which do not comply with the Contract Documents will be listed in a "Observation of Work" report which will be sent to the Contractor for immediate action. The Contractor shall correct all deficiencies in a prompt concise manner. After completion of the outstanding items, provide a written confirmation report for each item to the A/E. The report shall indicate each item noted, and method of correction. Enter the date on which the item was corrected, and return the signed reports so items can be rechecked. Failure to correct the deficiencies in a prompt concise manner or failure to return the signed reports shall be cause for disallowing request for payments.
- C. Items noted after acceptance during one-year guarantee period shall be checked by the Contractor in the same manner as above. The signed reports are to be returned by him when the items have been corrected.

#### 1.22 SYSTEMS WARRANTY

- A. Reference the General Conditions.
- B. The work shall include a one-year warranty. This warranty shall be by the Contractor to the Owner for any defective workmanship or material which has been furnished at no cost to the Owner for a period of one year from the date of substantial completion of each System. Warranty shall not include lamps in service after one month from date of substantial completion of the System. Explain the provisions of warranty to the Owner at the "Demonstration of Completed System" meeting to be scheduled with the Owner upon project completion.
- C. Where items of equipment or materials carry a manufacturer's warranty for any period in excess of twelve (12) months, then the manufacturer's warranty shall apply for that particular piece of equipment or material.
- D. Where extended warranty or guarantee are called for herein, furnish three copies to be inserted in Operation and Maintenance Manuals.
- E. All preventative maintenance and normal service will be performed by the Owner's maintenance personnel after final acceptance of the work which shall not alter the Contractor's warranty.

#### 1.23 WASTE MATERIALS DISPOSAL

- A. Contractor shall include in his bid the transport and disposal or recycling of all waste materials generated by this project in accordance with all rules, regulations and guidelines applicable. Contractor shall comply fully with Florida Statute 403.7186 regarding mercury containing devices and lamps. Lamps, ballasts and other materials shall be transported and disposed of in accordance with all DEP and EPA guidelines applicable at time of disposal. Contractor shall provide owner with written certification of accepted disposal.

#### 1.24 SUBSTANTIAL COMPLETION

- A. The Contractor shall be fully responsible for contacting all applicable parties A/E or Project Manager to schedule required observations of the work by Engineer. [A minimum of 72 hours notice shall be given for all required observations of the work by Engineer, and minimum of 120 hours for substantial completion observation. Time and date shall be agreed on by all applicable parties in writing.
- B. Work shall be complete as required by authorities having jurisdiction and the general conditions of the contract prior to request for substantial completion observation. Work must be deemed substantially complete by A/E to fulfill requirements.

#### 1.25 PROHIBITION OF ASBESTOS AND PCB

- A. The use of any process involving asbestos or PCB, and the installation of any product, insulation, compound of material containing or incorporating asbestos or PCB, is prohibited. The



requirements of this specification for complete and operating electrical systems shall be met without the use of asbestos or PCB.

- B. Prior to the final review field visit, the Contractor shall certify in writing that the equipment and materials installed in this Project under this Division 16 contain no asbestos or PCB. Additionally, all manufacturers shall provide a statement with their submittal that indicates that their product contains no asbestos or PCB. This statement shall be signed and dated by a duly authorized agent of the manufacturer.

PART 2 - PRODUCTS (Not Applicable)

PART 3- EXECUTION (Not Applicable)

END OF SECTION

SECTION 16012 - SUBMITTALS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Requirements for submittals specifically applicable to Division 16 Sections, in addition to Division 1 - General Requirements and any supplemental requirements/conditions.
- B. See Section 16013 - SUBSTITUTIONS for additional requirements when submittal consists of accepted substitution equipment.

1.3 SUBMITTAL OF "ACCEPTED SUBSTITUTE" EQUIPMENT/PRODUCT

- A. Representation: In submitting item, equipment, product, etc. that has been listed on contract drawings, in contract documents or in an addenda, Contractor represents that he:
  - 1. Has investigated substituted item and has determined that it is equal or superior to specified product in all aspects and that use of substituted item will not require any additional time to the Contract.
  - 2. Will coordinate installation of accepted substitution into work, making changes as may be required to complete work in all aspects.
  - 3. Waives all claims for additional costs related to substitution which may subsequently become apparent.
  - 4. Will provide the same warranties for the substitution as for the product specified.
  - 5. Will absorb all costs incurred by the substitution when affecting other trades including but not limited to electrical, structural, architectural, etc.
  - 6. Will absorb any cost incurred by the Engineer in review of the substituted product if the acceptance of the substituted item creates the need for system modification and/or redesign, or if the substituting contractor exhibits negligence in his substituting procedure thus submitting inferior, misapplied or miss-sized equipment. In the event of additional engineering costs, the billing structure shall be agreed upon prior to review by all involved parties.
- B. Substitutions that cannot meet space requirements or other requirements of these Specifications, whether accepted or not, shall be replaced at the Contractor's expense with no additional time added to the Contract.

1.4 SUBMITTALS

- A. Submittals shall consist of a minimum of one (or if required) two hard cover view type 3-ring binder(s) White, sized to hold 8-1/2" x 11" sheets; one (1) for "ELECTRICAL SUBMITTALS" (Power and Lighting); one (1) for "SYSTEMS SUBMITTALS" (Sections 16700 through 16799). Where "SYSTEMS SUBMITTALS" (Sections 16700 through 16799) is not applicable, only one (1) binder is required.
  - 1. Binder is to be adequately sized to comfortably hold required submittals. Minimum spline size to be 1", maximum spline size to be 3" (provide additional binders if 3" size is not sufficient to properly hold submittals).
  - 2. Binder cover and spline to have outer clear vinyl pockets. Provide correct designation of project in each pocket; see Binder Examples for Submittals included at end of this

Section. Description sheet is to be white with black letters, minimum of 11" high and full width of pocket. Description is to describe project and match project drawing/project manual description. Description to include submittal type, i.e., "ELECTRICAL SUBMITTALS" for Power and Lighting, (and if required) "SYSTEMS SUBMITTALS" for Sections 16700 - 16799 submittals.

B. Submittals Binders to include:

1. First sheet shall be prepared and filled out by Contractor and shall list project addresses, telephones, etc.; see "PROJECT ADDRESSES" Form included at end of this section.
2. Second sheet in binder shall be a photocopy of the Electrical Index pages in Specifications.
3. Provide reinforced separation sheets tabbed with the appropriate specification reference number and typed index for each section in the Systems Schedule.
4. Submittals consisting of marked catalog sheets or shop drawings shall be inserted in the binder in proper order. Submittal data shall be presented in a clear and thorough manner. Clearly mark each copy to identify pertinent products or models applicable to this project. Indicate all optional equipment and delete non-pertinent data. Markings shall be made with arrows or circles (highlighting is not acceptable).
5. Shop Drawings: Drawings to include identification of project and names of Architect, Engineer, General Contractor, subcontractor and supplier, data, number sequentially and indicate the following:
  - a) Fabrication and erection dimensions.
  - b) Arrangements and sectional views.
  - c) Necessary details, including complete information for making connections with other work.
  - d) Kinds of materials and finishes.
  - e) Descriptive names of equipment.
  - f) Modifications and options to standard equipment required by the work.
  - g) Leave blank area, size approximately 4 by 2 1/2 inches, near title block (for A/E's stamp imprint).
  - h) In order to facilitate review of drawings, insofar as practicable, they shall be noted, indicating by cross reference the contract drawings, note, and specification paragraph numbers where items occur in the Contract Documents.
  - i) Conduit/raceway rough-in drawings.
  - j) Items requiring shop drawings include (but not limited to):
    1. Lightning protection system
    2. Special built light fixtures
    3. Each section of 16700 broad section (i.e., fire alarm, television, etc.).
    4. Special and/or modified equipment
    5. Main Service Entrance Boards
    6. UL listed fire and smoke stopping assemblies for each applicable penetration
  - k) See specific sections of Specifications for further requirements.

6. Product Data: Technical data is required for all items as called for in the Specifications regardless if item furnished is as specified.
  - a) Submit technical data verifying that the item submitted complies with the requirements of the Specifications. Technical data shall include manufacturer's name and model number, dimensions, weights, electrical characteristics, and clearances required. Indicate all optional equipment and changes from the standard item as called for in the Specifications. Furnish drawings, or diagrams, dimensioned and in correct scale, covering equipment, showing arrangement of components and overall coordination.
  - b) In order to facilitate review of product data, insofar as practicable, they shall be noted, indicating by cross reference the contract drawings, note, and/or specification paragraph numbers where and/or what item(s) are used for and where item(s) occur in the contract documents.
  - c) See specific sections of Specifications for further requirements.

#### 1.5 PROCESSING SUBMITTALS

- A. Submit under provisions of the General Requirements of the Contract and this section of the Specifications, whichever is the most strict.
- B. Quantity of submittals with marking on each copy shall be submitted under provisions of General Requirements of the Contract, Division 1, and this and other sections of the Specifications. Original submittal must contain 3-ring binders with:
  1. Project Addresses
  2. Index
  3. Separation Sheets
  4. Basic Materials
  5. Panelboards
  6. Light Fixtures
  7. Long Lead Items
  8. Systems Product Data
- C. Remainder of submittals are to be submitted no later than 60 days after award of contract or 60 days prior to Request for Substantial Completion whichever is earlier.
- D. The Contractor shall review all submittals before submitting to the A/E. No request for payment will be considered until the submittals have been reviewed and submitted for approval.
- E. Product Data: For standard manufactured materials, products and items, submit one (1) copy or sets of data (per binder). If submittal is rejected, resubmittal shall contain same quantity of new data.
- F. Shop Drawings: For custom fabricated items and systems (16700) shop drawings, initially submit a transparency (suitable for reproduction) together with two (2) prints made therefrom. When submittal is acceptable, furnish one (1) print per binder made from the accepted transparency.
- G. Shop Drawing Review Notation.

<u>Action</u>	<u>Description</u>
1. No Exception Noted	No exceptions taken. Resubmittal not required.

- |    |                        |  |
|----|------------------------|--|
| 2. | Rejected               | Not in compliance with Contract Documents. Resubmit.                   |
| 3. | Submit Specific Item   | Resubmit item as specified.  |
| 4. | Make Corrections Noted | Make corrections noted, resubmittal not required.                      |
| 5. | Revise and Resubmit    | Make corrections noted, resubmittal is required                        |
| 6. | Review not Required    | Not required for review. No action taken. Copy retained for reference. |
- H. Acceptance: When returned to Contractor, submittals will be marked with A/E's stamp. If box marked "Rejected" "Revise and Resubmit" or "Submit Specific Item" is checked, submittal is not accepted and Contractor is to correct and resubmit as noted, otherwise submittal is accepted and Contractor is to comply with notation making necessary corrections on submittal. Review comments will generally not be on each individual submittal sheet, and will be on a separate sheet attached to shop drawing transmittal, submittal as a whole or each submittal section.
- I. Note that the acceptance of shop drawings or other information submitted in accordance with the requirements specified above, does not assure that the Engineer, Architect, or any other Owner's Representative, attests to the dimensional accuracy or dimensional suitability of the material or equipment involved, the ability of the material or equipment involved or the Mechanical/Electrical performance of equipment. Acceptance of shop drawings does not invalidate the plans and Specifications if in conflict, unless a letter requesting such change is submitted and accepted on the Engineer's letterhead.

#### 1.6 DELAYS

- A. Contractor is responsible for delays in job progress accruing directly or indirectly from late submissions or resubmissions of shop drawings, or product data.

#### 1.7 RE-SUBMITTALS

- A. The A/E shall be reimbursed for all costs to review resubmittals subsequent to the second submission for the same product. Cost will be billed to Contractor at Engineer's standard hourly rate.

PART 2 - PRODUCTS - Not Used

PART 3 - EXECUTION - Not Used

END OF SECTION

PROJECT ADDRESSES

OWNER:

ARCHITECT:

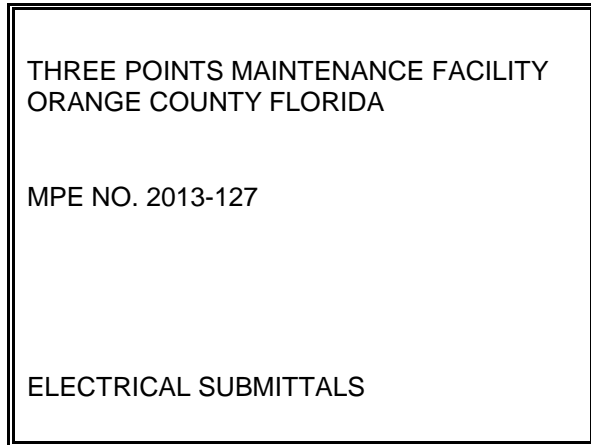
ENGINEER:

Matern Professional Engineering, Inc.  
130 Candace Drive  
Maitland, Florida 32751  
Telephone No.: (407) 740-5020  
Fax No.: (407) 740-0365

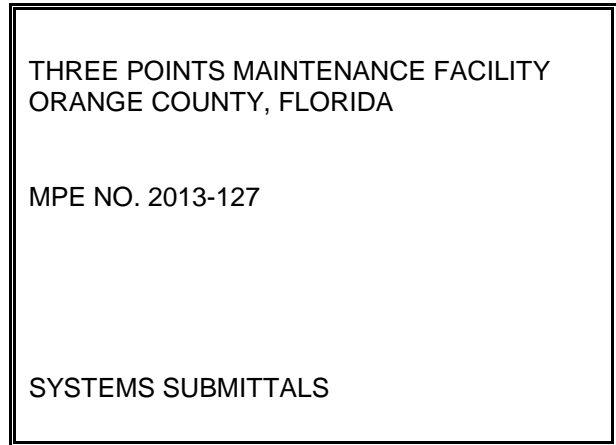
GENERAL CONTRACTOR:

SUBCONTRACTOR:

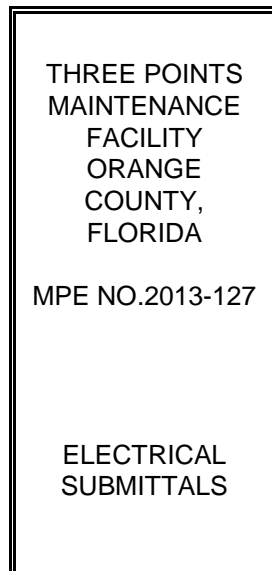
BINDER EXAMPLES FOR SUBMITTALS  
Insert In Vinyl Pockets (Front & Spline) 3-Ring Binder



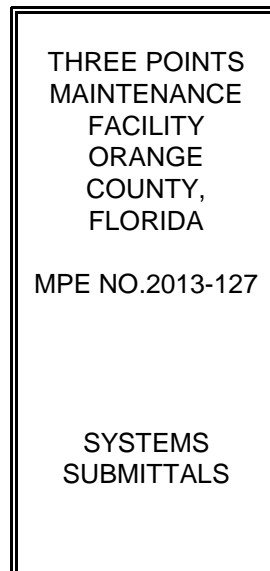
(Size To 8-1/2" x 11")



(Size To 8-1/2" x 11")



(Size To 11")



(Size To 11")

SECTION 16013 - SUBSTITUTIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section specifies general, administrative and procedural requirements for substitutions for Division 16 sections above and beyond the requirements of Division 1 General Requirements and any Supplemental requirements/conditions.
- B. Request for substitutions must be submitted no later than 10 days prior to bid due date.
- C. Request for substitution will not be considered after bid due date.

1.3 DEFINITIONS

- A. Definitions used in this Article are not intended to change or modify the meaning of other terms used in the Contract Documents.
- B. Substitutions: Products, materials, equipment, finishes, and methods of construction are considered substitutions if they meet any one of the following conditions:
  - 1. Does not meet all the requirements of these specifications under Part 1 - General or Part 2 - Products for any section included in Division 16 - Electrical Specifications.
  - 2. Is a different design which accomplishes the same result as that design specified in Division 16 - Electrical Specifications.
  - 3. Is of similar or different design that:
    - a) Requires more space.
    - b) Requires more power.
    - c) Requires changes in other elements of the work such as (but not limited to) architectural, mechanical, structural, or other electrical work.
    - d) Affects the construction schedule.
  - 4. Is listed in these specifications on the Contract Documents or in any addenda as an accepted substitution.

1.4 REQUEST FOR SUBSTITUTION SUBMITTALS (10 Days Prior to Bid Due Date)

- A. A separate request for substitutions shall be submitted for each product, material, etc. that is defined as a substitution.
- B. Submittal must consist of written request for substitution with data as required below. Request must be very specific as to what specified item, request for substitution is submitted for.
- C. Each request for substitution submittal for each product, etc. shall include:
  - 1. Name of material or equipment for which it is to be substituted.
  - 2. Drawings, product data, performance data and/or other information necessary for the engineer to determine that the equipment meets all specifications and requirements.
  - 3. Proof that pole lighting fixture and pole meet applicable wind loading requirements. Pole lighting fixtures must be submitted showing proof that they comply with the applicable wind loading requirements for location of this project.



4. Compliance Statement. Each request shall include the following compliance statement typed on letterhead of submitting company:
  - a) Submittal complies with all aspects/requirements of Contract Documents. (Yes or No). If no, state deviance.
  - b) Submittal complies with all applicable codes. (Yes or No). If no, state deviance.
  - c) Submittal complies with all other elements of the work and does not require any other changes. (Yes or No). If No, state required change.
  - d) Meets or exceeds the performance of specified product. (Yes or No). If no, state required change.

1.5 REQUEST FOR SUBSTITUTION SUBMITTALS (AFTER BID)

- A. Substitution requests submitted after bid will not be reviewed.
- B. Submittals for items noted as an Accepted Substitution on Contract Drawings, these specifications, or listed in an addenda, shall be submitted as required in Section 16012 - Submittals.

1.6 CONSIDERATION AND ACCEPTANCE

- A. Request for substitutions will not be considered if:
  1. Submittal does not comply with all requirements as noted above or contain all information required above.
  2. If submittal does not contain Compliance Statement, fully filled out.
  3. If Compliance Statement contains a 'no' or 'N'.
  4. Submittals are submitted beyond time limitations noted above.
- B. Samples.
  1. Sample may be required to be submitted, if deemed necessary by the A/E to determine if the substitution meets specifications.
  2. Where required by A/E on an individual basis, samples may be required after written notice of acceptance and approval has been made of each substitution.
  3. The A/E reserves the right to reject sample and consequently the substitution should the sample not meet the requirement of the contract documents.
- C. Substitutions will be considered on basis of design, concept of the Work, and overall conformance with information given in Contract Documents, including but not limited to:
  1. Design criteria, which shall be equal or superior to the specified item.
  2. Finishes, which shall be identical or superior to finishes of specified product.
  3. Lenses or louvers, which shall be identical size, thickness and type material specified.
  4. Physical size and dimension which are identical or within design criteria limitations as determined by the Engineer.
  5. Photometric data, which shall be identical or superior in quantity and quality.
  6. Trim detail and mechanical qualities, which shall be identical or within design criteria limitations as determined by the Engineer.
- D. The Engineer's decision on acceptance or rejection of substitutions will be final.
- E. Substitution requests, if accepted will be included in an addenda.

- F. Approval of a substituted item or listing a substituted item as an accepted substitution, does not modify or act as a waiver in any way, the requirements of the contract documents. See Section 16012 for additional requirements on accepted substitution submittals, equipment, etc.
- G. The naming of any manufacturer as an accepted substitution does not imply automatic approval as a substitution. It is the sole responsibility of the Contractor to ensure that any price quotations received and submittals made are for systems that meet or exceed these specifications.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION

SECTION 16014 - REFERENCE STANDARDS AND REGULATORY REQUIREMENTS

PART 1- GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Reference Standards and Regulatory Requirements specifically applicable to Division 16 sections.

1.3 REFERENCES

- A. The following references may be referenced within these specifications:

AASHTO	American Association of State Highway and Transportation Officials
ACA	American Correctional Association
ADA	Americans with Disabilities Act
AHERA	Asbestos Hazard Emergency Response Act
AIA	American Institute of Architects
ANSI	American National Standards Institute
ASCE	American Society of Civil Engineers
ASHRAE	American Society of Heating, Refrigerating and Air Conditioning Engineers
ASME	ASME International American Society of Mechanical Engineers International
ASTM	ASTM International American Society for Testing and Materials International
BOR	Board of Regents
BICSI	BICSI, Inc.
BOCC	Board of County Commissioners Orange County
COO	City of Orlando
COOBC	City of Orlando Building Code
CRSI	Concrete Reinforcing Steel Institute
DSC	Daytona State College Design Standards
D&B	Florida School for the Deaf and Blind

DCA-ADAIA	Department of Community Affairs - Florida Americans with Disabilities Accessibility Implementation Act
DCA-ADAAG	Department of Community Affairs - Florida Americans with Disabilities Act Accessibility Guidelines
DCA-ARM	Department of Community Affairs - Accessibility Requirements Manual
DER Rule 17-761	Department of Environmental Regulation, Chapter 17-761 on Underground Storage Tank Systems
DER Rule 17-762	Department of Environmental Regulation, Chapter 17-762 on Above Ground Storage Tank Systems.
DMS/DOC	Department of Management Services Division of Communications
DOCA or DCA	State of Florida Department of Community Affairs
EIA/TIA	Electronics Industries Alliance/Telecommunications Industry Association
EJCDC	Engineers Joint Contract Documents Committee American Consulting Engineers Council
FAC	Florida Administrative Code
FBC	Florida Building Code
FCC	Federal Communications Commission
FEMA	Federal Emergency Management Agency
FFPC	Florida Fire Prevention Code
FGC	Florida Building Code (Fuel Gas)
FLA	State of Florida
FMC	Florida Building Code (Mechanical)
FS	Florida Statutes
ICC	International Code Council
IEEE	Institute of Electrical and Electronics Engineers, Inc
IES	Illumination Engineering Society of North America
ICPEA	International Power Cable Engineer's Association
LPCR	Local Power Company Requirements
LPI	Lightning Protection Institute

LTCR	Local Telephone Company Requirements
NECPA	National Energy Conservation Policy Act
NESC	National Electrical Safety Code
NEMA	National Electrical Manufacturers Association
NFPA	National Fire Protection Association
OSHA	The Occupational Safety and Health Act
SBE	State Board of Education
SMACNA	Sheet Metal and Air Conditioning Contractors National Association
UFSRS	Uniform Fire Safety Rules and Standards of Insurance Division of State Fire Marshal
UL	Underwriters Laboratories, Inc.
NEC	National Electrical Code
FBC	Florida Building Code Section 423 State Requirements for Educational Facilities

#### 1.4 REGULATORY REQUIREMENTS

- A. Conform to all the applicable requirements of the following codes, standards, guidelines, etc.. If there should be conflicting requirements between these codes, standards, guidelines, etc., the more or most stringent requirement shall apply that does not violate any codes or laws.
1. Standards and Miscellaneous Codes/Requirements (Comply with latest edition or notice available unless otherwise adopted by Authority Having Jurisdiction):
    - a) Americans with Disabilities Act of 1990, as amended
    - b) ADA Standards for Accessible Design, 2010
    - c) American National Standards Institute
    - d) American Society of Heating, Refrigerating and Air Conditioning Engineers
    - e) American Society of Mechanical Engineers
    - f) American Society for Testing and Materials
    - g) Concrete Reinforcing Steel Institute
    - h) Department of Community Affairs
    - i) Electronics Industries Association/Telecommunications Industry Association
    - j) Florida Building Code, 2010
    - k) Florida Fire Prevention Code, 2010
    - l) Institute of Electrical and Electronics Engineers
    - m) Illumination Engineering Society
    - n) Local Power Company Requirements
    - o) Lightning Protection Institute
    - p) Local Telephone Company Requirements
    - q) National Electrical Code, 2008
    - r) National Energy Conservation Policy Act
    - s) National Electrical Safety Code

- t) National Electrical Manufacturers Association
- u) NFPA 1 Fire Code, 2009
- v) NFPA 101 Life Safety Code, 2009
- w) Occupational Safety and Health Act
- x) Safety Code for Elevators and Escalators  
A17.1a, 2008 and A17.1b, 2009 Addenda
- y) Safety Code for Existing Elevators and Escalators  
A17.3, 1996
- z) Sheet Metal and Air Conditioning Contractors
- aa) Underwriters Laboratories, Inc.
- bb) Applicable Federal, State, Local Codes, Laws and Ordinances, Florida Statutes  
and Referenced Codes/Standards

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION

SECTION 16015 - ELECTRICAL SYMBOLS AND ABBREVIATIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Symbols and abbreviations specifically applicable to all Division 16 sections in addition to those in Division 1 - General Requirements and any supplemental requirements/conditions.

1.3 SYMBOLS

- A. In general the symbols used on the drawings conform to the Standard Symbols of the Institute of Electrical and Electronic Engineers with the exception of special systems or agencies as hereinafter noted.
  - Corps of Engineers.
  - Special Symbols as shown in schedules or legends.

1.4 ABBREVIATIONS

- A. The following abbreviations or initials are used.
  - A/C Air Conditioning
  - AFD Adjustable Frequency Drive
  - AC Alternating Current
  - ADD # Addendum #
  - A/E Architect/Engineer (or Engineer when Architect not applicable)
  - AFF Above Finished Floor
  - AFG Above Finished Grade
  - AHU Air Handler Unit
  - AIC Amps Interrupting Capacity
  - AL Aluminum
  - ALT Alternate
  - AMP Ampere
  - ANSI American National Standards Institute
  - AWG American Wire Gauge
  - @ At
  - B.C. Bare Copper
  - BIDS Baggage Information Display System
  - BLDG Building
  - BRKR Breaker
  - BTU British Thermal Unit
  - BTUH BTU Per Hour
  - C Conduit
  - CB Circuit Breaker
  - CBM Certified Ballast Manufacturers
  - CCTV Closed Circuit Television
  - cd Candela
  - CFM Cubic Feet per Minute
  - CH Chiller
  - CKT Circuit
  - CKT BRKR Circuit Breaker
  - C/L Center Line

Clg Ceiling  
Comp Compressor  
Conn Connection  
Cond Condenser  
Cont Continuous  
CRI Color Rendering Index  
CT Current Transformer  
CU Copper  
CU Compressor Condenser Unit  
CW Cold Water  
DB Direct Burial  
DC Direct Current  
Disc Disconnect  
DN Down  
DPST Double Pole Single Throw  
DWG Drawing  
EC Electrical Contractor (or General Contractor)  
EMT Electrical Metallic Tubing  
Equip Equipment  
EST Estimate  
FAAP Fire Alarm Annunciator Panel  
FACP Fire Alarm Control Panel  
FARP Fire Alarm Remote Panel  
FATC Fire Alarm Terminal Cabinet  
FCCP Fire Alarm Command Center Panel  
FHC Fire Hose Cabinet  
FIDS Flight Information Display System  
FLA Full Load Amperes  
FT Feet  
FLR Floor  
FC Footcandles  
FVNR Full Voltage Non-Reversing  
GAL Gallon  
Galv Galvanized  
GPH Gallons per Hour  
GPM Gallons per Minute  
GFI Ground Fault Interrupting  
GRS Galvanized Rigid Steel Conduit  
GND Ground  
HTG Heaters  
HT Height  
Hz Hertz (Cycles)  
HPF High Power Factor  
HPS High Pressure Sodium  
HP Horsepower  
HR Hour  
HS Heat Strip  
ICTC Intercom Termination Cabinet  
IMC Intermediate Metallic Conduit  
Incand Incandescent  
in Inches  
JB Junction Box  
kVA KiloVolt Ampere  
kW Kilowatts



kWH Kilowatt Hour  
K Kelvin  
LLD Lamp Lumen Depreciation  
LED Light Emitting Diode  
LIU Light Interface Unit (Fiber Optic Patch Panel)  
LT Light  
LTG Lighting  
LTS Lights  
LPF Low Power Factor  
MCB Main Circuit Breaker  
MLO Main Lugs Only  
Maint Maintenance  
MH Manhole; Metal Halide  
MFG Manufacturer  
max Maximum  
MCM/KCMIL Thousand Circular Mils  
MPH Miles Per Hour  
MM Millimeter  
Min Minimum  
MCP Motor Circuit Protector  
MTD Mounted  
N Neutral  
NEC National Electrical Code  
NEMA National Electrical Manufacturers Association  
NFPA National Fire Protection Association  
NPT National Pipe Thread  
NF Non Fused  
NC Normally Closed  
NO Normally Open  
NIC Not in Contract  
No. Number  
OB Outlet Box  
OD Outside Diameter  
OL Overload  
OLS Overloads  
OS&Y Outside Screw and Yoke (Sprinkler)  
% Percent  
Ø Phase  
P Pole  
PL Compact Fluorescent Lamp  
PT Potential Transformer  
PSF Pounds per Square Foot  
PSI Pounds per Square Inch  
PB Pullbox  
PNL Panel  
PR Pair  
Pri Primary  
PTZ Pan, Tilt, Zoom  
PVC Polyvinyl Chloride  
Recept Receptacle  
RPM Revolutions per Minute  
RS Rapid Start  
SCA Short Circuit Amps  
Sec Secondary

SHT Sheet  
S/N Solid Neutral  
SPST Single Pole Single Throw  
SF Square Foot  
SW Switch  
SWBD Switchboard  
Sys System  
THHN; THWN Nylon Jacketed Wire  
TSP Twisted Shielded Pair  
TTB Telephone Terminal Board  
TTC Telephone Terminal Cabinet  
TV Television  
TVTC Television Terminal Cabinet  
TVEC Television Equip. Cabinet  
TYP Typical  
Temp. Temperature  
UL Underwriters' Laboratories  
UTP Unshielded Twisted Pair  
VFD Variable Frequency Drive  
VHF Very High Frequency  
VHO Very High Output  
V Volt  
VA Volt Amperes  
Vol. Volume  
VV Video Visitation  
W Wire  
W.P. Weatherproof  
XFMR Transformer  
Y Wye  
Yd Yard  
Yr Year  
3R Rainproof  
4X Stainless Steel Dusttight, Watertight

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION

SECTION 16090 - TESTS AND PERFORMANCE VERIFICATION OF ELECTRICAL SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This section pertains to the furnishing of all labor, materials, equipment and services necessary to test and prove performance of the electrical system.
- B. Operate system for a three day period. Do performance verification work as required to show that the system is operating correctly in accordance with design. Supply instruments required to read data. Adjust system to operate at the required performance levels.

PART 2 - PRODUCTS (Not Applicable)

PART 3- EXECUTION

3.1 TESTS

A. System:

1. General: After installation of all conductors and before final acceptance, make required tests to determine proper functioning of all circuits. Furnish all necessary instruments required to make tests and correct any deficiencies found. Prior to energizing, circuits shall be "rung-out" to verify opens, intentional and non-intentional grounds, continuity and detect short circuits by accepted constant megger.
2. Procedure:
  - a) All wires in conduit that are shorted or unintentionally grounded shall be replaced.
  - b) Insulation resistance of all feeder conductors and all conductors AWG #1 and larger shall be tested. This is to include all new conductors. Each conductor shall have its insulation resistance tested after the installation is completed and all splices, taps, and connections are made, except connection to source and point of final termination at distribution or utilization equipment.
  - c) Insulation resistance of conductors that are to operate at 600 volts or less shall be tested by using AVO Biddle (or accepted equal) megger at not less than 1000 volts dc. Resistance shall be measured from conductor to conduit (ground). Testing methodology shall conform to short-time or spot-reading procedural recommendations of AVO Biddle Instruments for specific megger being used. Acceptable insulation resistance of conductors rated at 600 volts shall not be less than 1 megohm.
  - d) Conductors that do not satisfy test requirements of paragraph c) above, shall be removed, replaced, and testing repeated on new cable at no additional cost to the Owner. All tests shall be performed by licensed electrician trained in the use of test instruments. Contractor shall furnish all instruments and personnel required for tests, shall tabulate readings observed and complete Conductor Insulation Resistance Test form (see Section 16098 Operation and Maintenance Manuals) and submit five copies to Engineer for acceptance. Test shall be witnessed by Owner's Representative and Engineer (if so desired). Final acceptance data is to be submitted in O & M Manual.
  - e) Test reports shall identify each feeder conductor tested, date, time, and result of test, weather conditions and range, test voltage, and serial number of the megger

instrument used. Any conductor or splice that is found defective shall be promptly removed and replaced and an additional test shall be performed.

- f) Observe all safety instructions set by testing equipment manufacturer. Application of voltage testing involves risk of electric shock and sparking.
3. Take readings of voltage and amperage at building main disconnect switch and at main for each panel, at primary and secondary side of each transformer and at the end of the longest branch circuit at each panel. The above readings shall be taken 1) "no load" conditions and 2) "full load" conditions with all equipment using electricity. Tabulate readings, complete Tabulated Data Voltage and Amperage Readings form (see Section 16098 Operation and Maintenance Manuals) and submit five copies to the Engineer for acceptance. Final accepted data is to be submitted in O & M Manual.
- B. Motors:
1. Test run each motor via motor's control unit in both manual mode and automatic mode. Verify proper operation, voltage and rotation.
  2. Test run each motor furnished under this Division of the Specifications and all existing motors specifically noted on the Drawings and/or Specifications to be tested:
    - a) With the system energized, line-to-line voltage and line current measurements shall be made at the motors under full load conditions. Should measured values deviate +/- 10% from the nameplate ratings, the condition shall be corrected. Notify the Engineer immediately should deviations occur.
    - b) Record results of existing motors tested and submit values to A/E in writing.
    - c) Test the insulation resistances of all motor windings to ground with a megger before applying line voltage to the motors. If these values are less than 1 megohm, the Contractor furnishing the motor shall be responsible for correcting the error.
    - d) Determine power factor of motor(s) at full load.
    - e) Tabulate readings, complete Motor Test Information form (see Section 16098 Operation and Maintenance Manuals) and submit five copies to the Engineer for acceptance. Final accepted data is to be submitted in O & M Manual.
- C. Grounds:
1. Test each raceway for raceway continuity as called for in Section 16170 Grounding and Bonding.
  2. Test each grounding system used in the project as called for in Section 16170 Grounding and Bonding.
  3. Submit Ground Test Information form (see Section 16098 Operation and Maintenance Manuals) for every grounding system in the project, including but not limited to, each ground rod installation; each water pipe and ground installation (test water pipe to ground and test water pipe to building service equipment), and each building steel ground connection (test building steel to ground and test building steel to building service equipment).
  4. Grounding resistance shall be as called for in Section 16170 Grounding and Bonding.
  5. Testing shall be 3-point method in accordance with IEEE recommended practice.
  6. Transformer grounding.
- D. Communications:
1. See specific sections of these Specifications for further requirements.

- E. Switchboard:
  - 1. See specific sections of these Specifications for further requirements.
- F. Service Ground Fault Protection System:
  - 1. See specific sections of these Specifications for further requirements.
- G. Ground Fault System:
  - 1. The ground fault protection system shall be performance tested when first installed on site. The test shall be conducted in accordance with instructions that shall be provided with the equipment. A written record of this test shall be made and shall be provided to the Authority Having Jurisdiction and to the Engineer of Record.

### 3.2 DATA PROCESSING

- A. Testing Data:
  - 1. Tabulate data for submission.
  - 2. Submit data on 8 1/2" x 11" sheets with date and name of checker with one copy for each O & M Manual.
  - 3. Where specific performance verification information is called for in the Specifications, use copies of the sheets provided for recording readings.
  - 4. Data shall be submitted and accepted before check-out memos are signed or a request for final inspection is made.
- B. Equipment Check Out:
  - 1. At completion of construction after all performance verification and testing information has been gathered, submitted, and approved, provide one copy of this information to the Authorized Manufacturer's Representative of the equipment.
    - a) Manufacturer's Authorized Representative must be trained by the manufacturer and authorized to inspect, adjust, test, and repair equipment.
  - 2. Work required under this section shall include having the representative examine the performance verification information, check the equipment in the field while it is in operation, and sign a Check Out Memo for a record. (See Section 16098 Operation and Maintenance Manuals).
    - a) Check out of equipment is to include examining performance of equipment and certifying equipment has been installed per manufacturer's recommendations, that all necessary adjustments have been performed and that equipment is operating properly.
  - 3. Submit one copy (for each O & M Manual) of the memo on each major item of equipment. Accepted memos shall be inserted in each O & M Manual with the performance verification information and submittal data. Memos shall be submitted and accepted before instruction to Owner or a request for final inspection.
  - 4. Items requiring Check Out Memos are all major items of equipment such as (but not limited to):
    - a) Panels, distribution panels, switchboards.
    - b) Transformers.
    - c) UPS equipment.
    - d) Equipment/systems installed per Sections 16700 thru 16799.

- e) Any other equipment noted to be checked-out by Engineer during construction.
  - f) Main Switchboard
  - g) IPS Equipment
5. Do not submit Check Out Memo form at the time submittal brochures are submitted. This form shall be completed and submitted before Instruction in Operation to Owner or a request for final inspection.

END OF SECTION

SECTION 16095 - DEMONSTRATION OF COMPLETED ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes the requirements for demonstration of completed electrical systems:

1.3 DESCRIPTION

- A. Demonstrate to Owner the essential features of the following electrical systems:

1. Communications Systems
  - a) Each and every system included in Sections 16700 through 16799.
2. Electrical Entrance Equipment
  - a) Circuit breakers
  - b) Fuses and fuseholders
  - c) Meters (where applicable)
3. Lighting Fixtures (include relamping and replacing lenses)
  - a) Exit and safety fixtures
  - b) Fixtures, indoor and outdoor
4. Lightning Protection System
5. Distribution Equipment
  - a) Lighting and appliance panelboards
  - b) Distribution panels
  - c) Switchboard
  - d) Voltage stabilizers
6. Standby Electrical Equipment
  - a) Batteries
  - b) Battery chargers
  - c) Controls and alarms
  - d) Emergency generators, transfer switches
  - e) UPS systems
7. Wiring Devices
  - a) Low-voltage controls
  - b) Switches: regular, time

- B. Upon completion of testing, each system is to be demonstrated only once.

1.4 TIME

- A. The demonstration shall be held upon completion of testing of all systems at a date to be agreed upon in writing by the Owner or his representative.

1.5 ATTENDING PARTIES

- A. The demonstration shall be held by this Contractor in the presence of the Owner and the manufacturer's representative.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 DEMONSTRATION

- A. Demonstrate the function and location (in the structure) of each system, and indicate its relationship to the riser diagrams and drawings.
- B. Demonstrate by "start-stop operation" how to work the controls, how to reset protective devices, how to replace fuses, and what to do in case of emergency.
- C. Performance Verification and Demonstration to Owner
  - 1. Submit Check Out Memo form for each item, equipment, and system. Copy to be included in each Operation and Maintenance Manual.

END OF SECTION



**CHECK OUT MEMO**

Check Out Memo shall be completed and a copy provided to the Owner at the Owner's Performance Verification and Demonstration Meeting. A copy shall also be included in the specification section of each O & M Manual for the equipment checked.

Project Name \_\_\_\_\_

Type of Equipment Checked \_\_\_\_\_

Equipment Number \_\_\_\_\_

Equipment Manufacturer \_\_\_\_\_

Signature below by the manufacturer's authorized representative signifies that the equipment has been satisfactorily tested and checked out on the job by the manufacturer.

1. The attached Test and Data and Performance Verification information was used to evaluate the equipment installation and operation.
2. The equipment is properly installed, has been tested by the manufacturer's authorized representative, and is operating satisfactorily in accordance with all requirements, except for items noted below.\*
3. Written operating and maintenance information has been presented and reviewed in detail with the Contractor.
4. Sufficient copies of all applicable operating and maintenance information, parts lists, lubrication checklists, and warranties have been furnished to the Contractor for insertion in the Operation and Maintenance Manuals.

**CHECKED BY:**

\_\_\_\_\_  
MANUFACTURER'S REPRESENTATIVE (print)

\_\_\_\_\_  
ADDRESS

\_\_\_\_\_  
TELEPHONE, FAX, E-MAIL

\_\_\_\_\_  
MANUFACTURER'S REPRESENTATIVE (signature, title)

\_\_\_\_\_  
DATE CHECKED

**WITNESSED BY:**

\_\_\_\_\_  
CONTRACTOR'S REPRESENTATIVE (signature, title)

**\*EXCEPTIONS NOTED AT TIME OF CHECK-OUT (USE ADDITIONAL PAGE IF NECESSARY)**

SECTION 16098 - OPERATION AND MAINTENANCE MANUALS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, Division 1 and Division 16 Specification Sections apply to this Section.
- B. The requirements in this section of the specifications are in addition to all requirements in sections referenced above.

1.2 SUMMARY

- A. This section includes the requirements for Operation and Maintenance Manuals (O & M Manuals) specifically applicable to Division 16 Sections, in addition to Division 1 - General Requirements and any supplemental requirements/conditions.

1.3 OPERATION AND MAINTENANCE MANUALS

- A. General: Refer to Section 01770 Closeout Procedures.
- B. O& M Manuals shall consist of a minimum of one (or if required) two hard cover view type 3-ring binder(s) sized to hold 8 1/2" x 11" sheets; one (1) for ELECTRICAL OPERATION AND MAINTENANCE (Power and Lighting) (black); one (1) for SYSTEMS OPERATION AND MAINTENANCE (Sections 16700 thru 16799) (blue). Where SYSTEMS OPERATION AND MAINTENANCE (Sections 16700 thru 16799) is not applicable, only one (1) binder is required. Refer to Division 1, general requirements for additional requirements.
  - 1. Each binder is to be adequately sized to comfortably hold required submittals. Minimum spline size to be 1", maximum spline size to be 3". Provide additional binders if 3" size is not sufficient to properly hold submittals.
  - 2. Binder cover and spline to have outer clear vinyl pockets. Provide correct designation of project in each pocket; see Binder Examples for O & M's in Section 01770 Closeout Procedures at the end of this Section. Description sheet is to be white with black letters, minimum of 11" high and full width of pocket. Description is to describe project and match project drawing/project manual description. Description to include submittal type, i.e. ELECTRICAL OPERATION AND MAINTENANCE for Power and Lighting, (and if required) SYSTEMS OPERATION AND MAINTENANCE for Sections 16700 - 16799.
- C. O & M Data:
  - 1. Manufacturer's operation and maintenance data is required for all items as called for in the specifications. O & M Manuals shall include manufacturer's name, model number(s), characteristics, manufacturer's agent, service agent, supplier, where and/or what item(s) are used for and description (i.e. surge suppression - switchboard MDPA).
  - 2. Include troubleshooting instructions, list of special tools required, theory of operation, manufacturer's care and cleaning, preventative maintenance instructions, wiring diagrams, and point-to-point schematics.
- D. O & M Manuals to include:
  - 1. Completed forms and information per Division 1, General Requirements, and this section of the specifications.
    - a) Table of Contents
    - b) Project Addresses
    - c) Reinforced Separation Sheets tabbed with the appropriate specification reference number and typed index for each Section in the Systems Schedule
    - d) Check Out Memo
    - e) Conductor Insulation Resistance Test Memo
    - f) DC High Voltage Cable Test Report

- g) Ground Test Information
  - h) Motor Test Information
  - i) Voltage and Amperage Readings Tabulated Data.
  - j) Progress and Record Drawing Certification
  - k) Spare Parts Certification Memo
2. Shop Drawings: Shop drawings shall be a copy of the final and accepted shop drawing submitted as required in Section 16012 "Submittals". These shall be inserted in binder in proper order.
  3. Product Data: Product data and/or Catalog sheets shall be a copy of the final and accepted submittal submitted as required in Section 16012 "Submittals". These shall be inserted in binder in proper order.
  4. Warranty/Guarantee: Provide copy of warranty/guarantee in respective location in O & M binder, (Power and Lighting) (Systems). Original warranty/guarantee is to be incorporated into separate project warranty book with warranty/guarantees provided for other sections and divisions of the specifications and submitted for Architectural/Owner acceptance.
  5. Copies of electrical panel schedules and electrical panel directories included with the corresponding specification section
  6. Wiring diagrams, schematic, etc. inserted in proper order, for:
    - a) Time clocks.
    - b) Photocells.
    - c) Emergency Generator systems.
    - d) Automatic transfer switches.
    - e) Transformers.
    - f) Panelboards.
    - g) Distribution panelboards.
    - h) Switchboards.
    - i) Each and every part of the Systems sections of these Specifications, 16700 thru 16799.
  7. For Section 16100 thru 16199:
    - a) Product data and/or catalog sheets on all equipment applicable to this project.
    - b) Equipment supplier list for each section's equipment.
    - c) Floor boxes; in addition to above provide:
      1. Installation/removal instructions.
      2. Parts list.
    - d) UPS system; in addition to above provide:
      1. Wiring diagrams.
      2. Parts list.
      3. Installation/removal instructions.
      4. Operation and maintenance requirements.
      5. Copy of maintenance contract.
      6. Preventive maintenance instructions.
      7. Check-Out Memo Form
    - e) Ground fault wiring devices; in addition to above provide:
      1. Wiring diagram.
    - f) Grounding; in addition to above provide:
      1. Test results on each ground rod.
      2. Ground Test Information Form
  8. Sections 16400 thru 16499:
    - a) Product data and/or catalog sheets on equipment applicable to this project.
    - b) Equipment supplier list for each sections equipment.
    - c) Transformers; in addition to above provide:
      1. Recommended periodic testing procedures.

2. Parts list.
  3. Any special manufacture suggested O & M information.
  4. Installation/removal instructions.
  5. Check-Out Memo Form
  - d) Panels, distribution panelboards, switchboards; in addition to above provide:
    1. Internal wiring diagrams.
    2. Bus diagrams.
    3. Operation and maintenance requirements, instructions, and recommended testing.
    4. Parts list.
    5. Copy of directory.
    6. Voltage and Amperage Readings Tabulated Data Form
    7. Check-Out Memo Form
  - e) Overcurrent protective devices; in addition to above provide the following for large circuit breakers:
    1. Parts list.
    2. Operation and maintenance requirements.
    3. Wiring diagrams.
    4. Testing data.
    5. Installation/removal instructions.
    6. Check-Out Memo Form
  - f) Motor Control; in addition to above provide the following:
    1. Internal wiring diagrams.
    2. Wiring diagrams.
    3. Bus diagrams.
    4. Operation and maintenance requirements, instructions, and recommended testing.
    5. Parts list.
    6. Copy of directory.
    7. Testing data, motor test information sheets.
    8. Check-Out Memo Form
9. Section 16500:
- a) Product data and/or catalog sheets on all equipment applicable to this project.
  - b) Equipment supplier list for each sections equipment.
  - c) Lighting fixtures; in addition to above provide the following:
    1. Operation and maintenance requirements/instructions for special light fixtures (these fixtures to be determined by A/E) including:
      - (a) installation/removal instructions.
      - (b) special re-lamping instructions.
    2. Parts list.
10. Section 16600:
- a) Product data and/or catalog sheets on all equipment applicable to this project.
  - b) Equipment supplier list for each sections equipment.
  - c) Lightning Protection System: In addition to the above provide:
    1. Shop drawing.
    2. Product data on all components.
    3. Parts list.
    4. Operation and maintenance procedures.
    5. Copy of lightning protection system master label.
    6. Installer's name, address, etc.
  - d) Surge Suppression:
    1. Product data and/or catalog sheets on equipment applicable to this project.
    2. Parts list.
    3. Recommended testing and replacement procedures.

- e) Emergency Generator, Emergency Control/System/Switchboard
  - 1. Internal wiring diagrams
  - 2. Wiring diagrams
  - 3. Bus diagrams
  - 4. Operation and maintenance requirements, instructions and recommended testing
  - 5. Parts list.
  - 6. Copy of directory.
  - 7. Testing data, motor test information sheets
  - 8. Check Out Memo Form
  - 9. Narrative of emergency system operation, controls, etc.

11. Sections 16700 thru 16799

- a) Installer's name, address, phone, etc. for each system.
- b) Authorized representatives name, address, phone, etc. for each system.
- c) Equipment supplier's name, address, phone, etc. for each system.
- d) Surge Suppression.
  - 1. Product data and/or catalog sheets on equipment applicable to this project.
  - 2. Parts list.
  - 3. Recommended testing and replacement procedures.
- e) Fire Alarm, Sound/Paging, Television, Security, Closed Circuit systems.
  - 1. Product data and/or catalog sheets on equipment applicable to this project.
  - 2. Parts list.
  - 3. Installation/removal instructions.
  - 4. Wiring diagrams of panels.
  - 5. Point-to-point wiring diagrams of system.
  - 6. Operation and maintenance requirements.
  - 7. Shop drawing as submitted and accepted in submittal process.
  - 8. Check-Out Memo Form
- f) Telephone, Computer Systems.
  - 1. Product data and/or catalog sheets on equipment applicable to this project.
  - 2. Parts list.
  - 3. Wiring diagrams of panels.
  - 4. Shop drawing as submitted and accepted in submittal process.

1.4 PROCESSING SUBMITTALS

- A. Submit a minimum of three (3) sets of O & M Manuals, two (2) sets for Owner, one (1) set for Engineer.
- B. The Contractor shall review the manuals before submitting to the A/E. No request for payment will be considered until the brochure has been reviewed and submitted for acceptance.
- C. Provide additional copies if additional copies are required in other Divisions and/or sections of these specifications.

1.5 DELAYS

- A. Contractor is responsible for delays in job project accruing directly or indirectly from late submissions or resubmissions of shop drawings, or product data.

1.6 RESUBMITTALS

- A. The A/E shall be reimbursed cost to review re-submittals subsequent to the second submittal.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

PROJECT ADDRESSES

OWNER:

ARCHITECT:

CONSULTING ENGINEER:

Matern Professional Engineering, Inc.  
130 Candace Drive  
Maitland, Florida 32751  
Telephone No.: (407) 740-5020  
Fax No.: (407) 740-0365

GENERAL CONTRACTOR:

SUBCONTRACTOR:

CHECK OUT MEMO FORM

This form shall be completed and a copy provided to the Owner at the Owner's Performance Verification and Demonstration meeting. A copy shall also be included in the specification section of each O & M Manual for the equipment checked.

Project Name:

Type of equipment checked:

Equipment Number:

Name of manufacturer of equipment:

Signature below by the manufacturer's authorized representative signifies that the equipment has been satisfactorily tested and checked out on the job by the manufacturer.

1. The attached Test and Data and Performance Verification information was used to evaluate the equipment installation and operation.
2. The equipment is properly installed, has been tested by the manufacturer's authorized representative, and is operating satisfactorily in accordance with all requirements, except for items noted below.\*
3. Written operating and maintenance information has been presented to the Contractor, and gone over with him in detail.
4. Sufficient copies of all applicable operating and maintenance information, parts lists, lubrication checklists, and warranties have been furnished to the Contractor for insertion in the Operation and Maintenance Manuals.

Checked By: (Print or Type Name of Manufacturer's Representative)

(Address and Phone No. of Representative)

(Signature and Title of Representative)

(Date Checked)

Witnessed By: Signature and Title of Contractor Rep.)

\*Exceptions Noted At Time Of Check-Out (use additional page if necessary)

CONDUCTOR INSULATION RESISTANCE TEST MEMO

PROJECT NAME: \_\_\_\_\_

CONDUCTOR FROM \_\_\_\_\_ TO

SIZE

INSULATION TYPE

INSULATION VOLTAGE RATING

DATE \_\_\_\_\_ TIME

WEATHER CONDITIONS

TEST VOLTAGE (DC)

RANGE

MEGGER INSTRUMENT/SERIAL NUMBER

TESTING METHODOLOGY

INSULATION RESISTANCE MEASUREMENT (ACCEPTABLE MEASUREMENT NOT TO BE LESS THAN (1) MEGOHM):

PHASE A TO GROUND \_\_\_\_\_

PHASE B TO GROUND \_\_\_\_\_

PHASE C TO GROUND \_\_\_\_\_

NEUTRAL TO GROUND \_\_\_\_\_

ISOLATED GROUND TO GROUND \_\_\_\_\_

CONTRACTOR'S REPRESENTATIVE:

DATE:

OWNER'S REPRESENTATIVE:

DATE:

ENGINEER'S REPRESENTATIVE:

DATE:



DC HIGH VOLTAGE CABLE TEST REPORT

Project Name: \_\_\_\_\_

Location: \_\_\_\_\_

Description: \_\_\_\_\_

Rated Voltage: \_\_\_\_\_

TEST DATA

Set Leakage @ Test Voltage \_\_\_\_\_ ma Variac \_\_\_\_\_

Pri. Voltage \_\_\_\_\_

Sphere Gap \_\_\_\_\_ Inches

Duct Temp. \_\_\_\_\_ Ambient Temp. \_\_\_\_\_ Weather \_\_\_\_\_

Cable Status \_\_\_\_\_ 1 hour prior to test

Phase or Conductor	A	B	C	Remarks
Starting Time	MA	MA	MA	

- 0
- 15 sec.
- 30 sec.
- 45 sec.
- 1 min.
- 2 min.
- 3 min.
- 4 min.
- 5 min.

Final Test Voltage \_\_\_\_\_

Time Finish: \_\_\_\_\_

KV DC after 1 min.

Test Procedure \_\_\_\_\_ No. of Terminals \_\_\_\_\_

Joints \_\_\_\_\_

Witnessed by: \_\_\_\_\_ Performed by: \_\_\_\_\_

GROUND TEST INFORMATION

PROJECT NAME: \_\_\_\_\_

GROUND TYPE: \_\_\_\_\_

TEST BY: \_\_\_\_\_

DATE OF TEST: \_\_\_\_\_

GROUND LOCATION: \_\_\_\_\_

GROUND TYPE (Rod, Water pipe, etc.):

PRIOR TO CONNECTION TO SYSTEM

GROUND: \_\_\_\_\_ (OHMS)

AFTER CONNECTION TO SYSTEM

GROUND: \_\_\_\_\_ (OHMS)

WEATHER CONDITIONS (Wet/Dry):

SOIL CONDITIONS (Wet/Dry):

CONTRACTOR'S REPRESENTATIVE:

DATE:

ENGINEER'S REPRESENTATIVE:

DATE:

OWNER'S REPRESENTATIVE:

DATE:

MOTOR TEST INFORMATION

PROJECT NAME:  
DESCRIPTION OF MOTOR:  
NAME OF CHECKER:  
DATE CHECKED:

(a) Name and identifying mark of motor (indicate at existing)

(b) Manufacturer

(c) Model Number

(d) Serial Number

(e) RPM

(f) Frame Size

(g) Code Letter

(h) Horsepower

(i) Nameplate Voltage and Phase

(j) Nameplate Amps

(k) Actual Voltage

(l) Actual Amps

(m) Starter Manufacturer

(n) Starter Size

(o) Heater Size, Catalog No. and Amp Rating

(p) Manufacturer of dual-element fuse

(q) Amp rating of fuse

(r) Power Factor

CONTRACTOR'S REPRESENTATIVE:

DATE:

SIGNATURE OF CHECKER:

DATE:

OWNER'S AUTHORIZED REPRESENTATIVE:

PROGRESS AND RECORD DRAWING CERTIFICATION

NAME OF PROJECT:

DIVISION NUMBER AND NAME:

This is to certify that the attached marked-up design prints were marked as the items were installed at the site during construction, and that these prints represent as accurate "As-Builts" record of the work as actually installed. One copy will be turned over to the Owner at the instruction in Operation Conference. The duplicate copy is for the Engineer's files.

---

Name Of General Contractor

---

BY: Authorized Signature And Title

Date

Name Of Subcontractor

---

BY: Authorized Signature And Title

Date

SPARE PARTS CERTIFICATION MEMO

This form shall be completed and a copy provided to the Owner at the Owner's Performance Verification and Demonstration meeting. A copy shall also be included in the specification section of each O & M Manual for the equipment checked.

Project Name:

Type of Spare Parts:

Specification Reference:

Quantity of Spare Parts:

Signature below by the contractor signifies that the spare parts required by the drawings and/or specifications have been turned over to the Owner.

---

(Name of General Contractor)

---

(Signature, Title, Date)

---

(Name of Subcontractor)

---

(Signature, Title, Date)

---

(Name of Owner)

---

(Signature, Title, Date)

VOLTAGE AND AMPERAGE READINGS (TABULATED DATA)

PROJECT NAME: \_\_\_\_\_  
SWITCHGEAR/PANELBOARD

FULL LOAD AMPERAGE READINGS:

DATE \_\_\_\_\_  
TIME \_\_\_\_\_

PHASE A. \_\_\_\_\_  
B. \_\_\_\_\_  
C. \_\_\_\_\_  
N. \_\_\_\_\_  
GROUND \_\_\_\_\_

FULL LOAD VOLTAGE READINGS:

DATE  
TIME

PHASE A TO N \_\_\_\_\_ A TO B  
B TO N \_\_\_\_\_ A TO C  
C TO N \_\_\_\_\_ B TO C

VOLTAGE AT THE END OF THE LONGEST BRANCH

TYPE OF LOAD

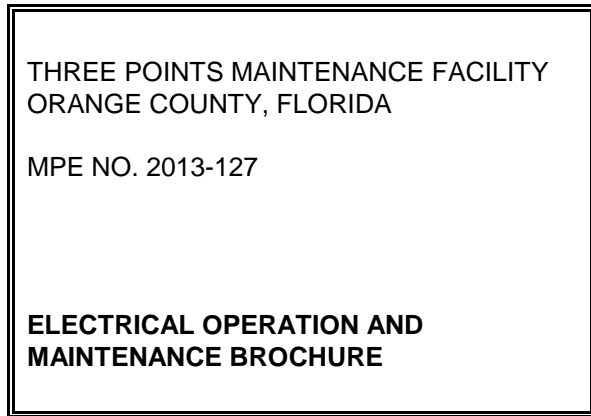
NO LOAD VOLTAGE READINGS:

DATE  
TIME

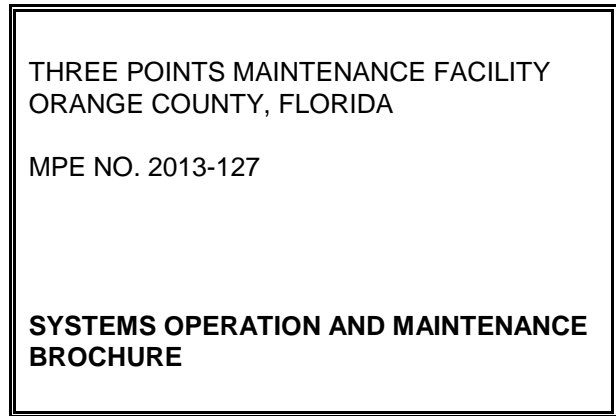
PHASE A TO N \_\_\_\_\_ A TO B  
B TO N \_\_\_\_\_ A TO C  
C TO N \_\_\_\_\_ B TO C

\_\_\_\_\_ ENGINEERS REPRESENTATIVE  
\_\_\_\_\_ OWNER'S AUTHORIZED REPRESENTATIVE  
\_\_\_\_\_ CONTRACTORS REPRESENTATIVE  
\_\_\_\_\_ DATE

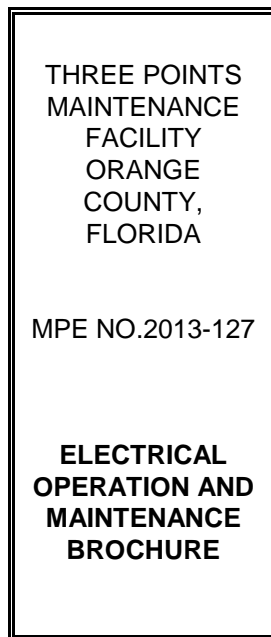
**BINDER EXAMPLES FOR SUBMITTALS**  
Insert In Vinyl Pockets (Front & Spline) 3-Ring Binder



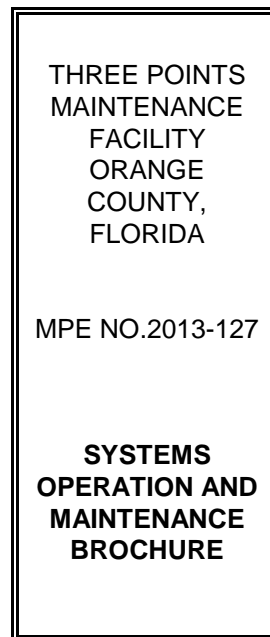
(Size To 8-1/2" x 11")



(Size To 8-1/2" x 11")



(Size To 11")



(Size To 11")

SECTION 16111 - CONDUIT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes requirements for electrical conduit.
- B. Provide and install all equipment, labor, material, accessories, and mounting hardware for a complete and operating system for the following:
  - 1. Rigid Metal Conduit (RMC) NEC 344
  - 2. Intermediate Metal Conduit (IMC) NEC 342
  - 3. Flexible Metal Conduit (FMC) NEC 348
  - 4. Liquidtight Flexible Metal Conduit (LFMC) NEC 350
  - 5. Electrical Metallic Tubing (EMT) NEC 358
  - 6. Rigid Polyvinyl Chloride Conduit (Type PVC) NEC 352
  - 7. Fittings and Conduit Bodies

1.3 REFERENCES

- A. ANSI C80.1 Electrical Rigid Steel Conduit, Zinc Coated
- B. ANSI C80.3 Steel Electrical Metallic Tubing, Zinc Coated
- C. ANSI/NEMA FB 1 Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing and Cable
- D. ANSI/NFPA 70 National Electrical Code
- E. NECA Standard Practice of Good Workmanship in Electrical Contracting
- F. NEMA RN 1 Polyvinyl Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit
- G. NEMA TC 2 Electrical Polyvinyl Chloride (PVC) Conduit (EPC 40, EPC 80)
- H. NEMA TC 3 Polyvinyl Chloride (PVC) Fittings for Use with Rigid PVC Conduit and Tubing

1.4 REGULATORY REQUIREMENTS

- A. Conform to requirements of ANSI/NFPA 70.
- B. Furnish products listed and classified by Underwriters Laboratories as suitable for purpose specified and shown.

1.5 DESIGN REQUIREMENTS

- A. Conduit Size: ANSI/NFPA 70. (See Drawings and this and other sections of these Specifications for additional requirements).
- B. Raceways and conduits shall begin at an acceptable enclosure and terminate only in another such enclosure except conduit/raceway stub-outs.
- C. A raceway shall be provided for all electrical power and lighting, and electrical systems unless specifically specified otherwise.

1.6 SUBMITTALS

- A. Submit catalog cut sheet showing brand of conduit to be used and showing that conduit is UL listed and labeled, and manufactured in the United States.
- B. Submit catalog cut sheet on all types of conduit bodies and fittings.
- C. Product data shall be submitted for acceptance on:



1. Conduits.
  2. Conduit straps, hangers and fittings.
  3. PVC solvent(s) and bending box.
  4. Fitting entering and leaving the ground or pavement.
- D. Submit UL listed fire and smoke stopping assemblies for each applicable application.
- E. Product data shall prove compliance with Specifications, National Electrical Code, National Board of Fire Underwriters, manufacturers' specifications and written installation data.
- 1.7 PROJECT RECORD DOCUMENTS
- A. Submit record documents to accurately record actual routing of conduits larger than 1.25".
- 1.8 DELIVERY, STORAGE, AND HANDLING
- A. Deliver, properly store and protect products at the site.
- B. Accept conduit on site. Inspect for damage.
- C. Protect conduit from sun, rain, corrosion and entrance of debris by storing above grade. Provide appropriate covering.
- D. Protect PVC conduit from sunlight.
- 1.9 PROJECT CONDITIONS
- A. Verify that field measurements are as shown on Drawings.
- B. Verify routing and termination locations of conduit prior to rough-in.
- C. Conduit routing is shown on Drawings in approximate locations unless dimensioned. Route as required to complete wiring system.

## PART 2 - PRODUCTS

### 2.1 GENERAL

- A. All conduits shall bear UL label or seal and shall be manufactured in the United States.
- B. Conduit systems and all related fittings, boxes, supports, and hangers must meet all the requirements of national, state, Orange County and other federal codes where applicable.

### 2.2 MINIMUM TRADE SIZE

- A. Homeruns: 3/4" C.
- B. Underground Branches: 3/4".
- C. Aboveground Branches: 1/2".
- D. Flexible and seal-tite metallic conduit 1/2" C (maximum 6' long).
- E. Rigid conduit - 3/4".
- F. Non-metallic conduit 3/4" C.
- G. EMT - 3/4".
- H. Flexible and seal-tite metallic conduit 1/2" C. (maximum 6' long).

### 2.3 RIGID METAL CONDUIT

- A. Comply with:
1. ANSI C80.1.
  2. UL 6.
  3. NEC 344.
- B. Conduit material:
1. Zinc coated or hot dipped galvanized steel.

- C. Fittings:
  - 1. Threaded.
  - 2. 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.
  - 3. Zinc plated or hot dipped galvanized malleable iron or steel.
- D. Conduit Bodies:
  - 1. Comply with ANSI/NEMA FB 1.
  - 2. Threaded hubs.
  - 3. Zinc plated or hot-dipped galvanized malleable iron.

#### 2.4 INTERMEDIATE METAL CONDUIT

- A. Comply with:
  - 1. UL Standard 1242.
  - 2. NEC 342.
- B. Conduit material: Zinc coated steel.
- C. Fittings:
  - 1. Threaded.
  - 2. Zinc plated malleable iron.
  - 3. Insulated bushings on terminations.
- D. Conduit bodies:
  - 1. Comply with ANSI/NEMA FB 1.
  - 2. Threaded hubs.
  - 3. Zinc plated or hot-dipped galvanized malleable iron.

#### 2.5 FLEXIBLE METAL CONDUIT

- A. Comply with:
  - 1. NEC 348.
  - 2. ANSI/UL 1.
- B. Conduit material: Steel, interlocked.
- C. Fittings:
  - 1. ANSI/NEMA FB 1.
  - 2. ANSI/UL 514B.
  - 3. Malleable iron, zinc plated.
  - 4. Threaded rigid and IMC conduit to flexible conduit coupling.
  - 5. Direct flexible conduit bearing set screw type not acceptable.

#### 2.6 LIQUID-TIGHT FLEXIBLE METAL CONDUIT

- A. Comply with:
  - 1. NEC 350.
  - 2. ANSI/UL 360.
- B. Conduit material:
  - 1. Flexible hot-dipped galvanized steel core, interlocked.
  - 2. Continuous copper ground built into core up to 1-1/4" size.
  - 3. Extruded polyvinyl gray jacket.
- C. Fittings:
  - 1. Threaded for IMC/rigid conduit connections.

2. Accepted for hazardous locations where so installed.
3. Provide sealing washer in wet/damp locations.
4. Compression type.
5. ANSI/NEMA FB 1.
6. ANSI/UL 514B.
7. Zinc plated malleable iron or steel.

## 2.7 ELECTRICAL METALLIC TUBING

- A. Comply with:
1. UL 797.
  2. ANSI C80.3.
  3. NEC 358.
  4. ANSI/UL797.
- B. Conduit material: Galvanized steel tubing.
- C. Fittings:
1. ANSI/NEMA FB 1.
  2. Compression Fittings
  3. Zinc plated malleable iron or steel.
  4. Concrete tight.
  5. T&B Series 5031/5030.

## 2.8 RIGID POLYVINYL CHLORIDE CONDUIT (Not permitted at fuel Island)

- A. Comply with:
1. NEMA TC 2.
  2. UL 651.
  3. NEC 352.
- B. Conduit material:
1. Shall be high impact PVC, tensile strength 55 psi, flexural strength 11000 psi.
- C. Fittings:
1. NEMA TC 3.
  2. UL 514.
- D. General:
1. Shall be UL listed and identified.
  2. Shall conform to all national, state and local codes.
  3. Manufacturer shall have five years experience in manufacturing PVC conduits.

## 2.9 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, intermediate metal 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.

## PART 3 - EXECUTION

### 3.1 LOCATION 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. Use galvanized rigid conduit(Required at Fuel Island), or PVC encased in steel-reinforced concrete.
  3. All conduits or elbows entering, or leaving the ground shall be rigid steel conduit coated with asphaltic paint.
  4. All underground raceways (with exception of raceways installed under floor slab) shall be installed in accordance with NEC 300.5, except the minimum cover for any conduit shall be 30" unless otherwise noted. 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.
  5. 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.
  6. PVC runs over 150' in length shall utilize rigid steel 90 degree 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 250.80 and NEC 300.5.
  7. All underground service lateral raceways shall be protected as required by NEC 300.5, including requirements for installation of warning tape.
- B. In Slab Above or on Grade:
1. Use coated rigid steel conduit, coated intermediate metal conduit (if accepted) or rigid non-metallic conduit.
  2. Coating of metallic conduit to be black asphaltic or PVC.
- C. Penetration of Slab:
1. Exposed Location:
    - a) Where penetrating a floor in an exposed location from underground or in slab, a black mastic coated or PVC coated galvanized rigid steel conduit shall be used.
  2. Concealed Location:
    - 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 48" above finished floor.
    - b) Where penetrating a floor in location other than that above use a black mastic coated or PVC coated galvanized rigid steel conduit.
- 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 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.
    - d) Exterior conduits not on roof and not subject to damage (i.e. 6' above grade/floor or higher) may be rigid non-metallic PVC conduit as specified elsewhere. (Schedule 40 for low voltage Class II wiring, Schedule 80 for power wiring.)
    - e) Exterior conduits from grade level to 6' above grade may be rigid non-metallic Schedule 40 PVC for low voltage Class II wiring provided rigid metal conduit is used at transition from below grade to 12" above grade (due to weed eater damage, etc.).
  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 shall be run underground.
  - 3. Roofs:
    - a) Conduit is not to be installed on roofs, without written authorization by A/E 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" 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 as accepted by roofing contractor.
  - E. Interior Dry Locations:
    - 1. Concealed: Use rigid metal conduit , intermediate metal conduit, electrical metallic tubing. Rigid non-metallic conduit may be used inside block walls up to first outlet to a maximum of 40" AFF except where prohibited by the NEC (places of assembly, etc.).
    - 2. Exposed: Use rigid metal conduit, intermediate metal conduit, 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 6' 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 2' in length, unless written authorization by A/E for specific conditions is granted.
  - F. Interior Wet and Damp Locations:
    - 1. Use rigid galvanized steel or intermediate metal 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).
  - H. Hazard Locations (Fuel Island):
    - 1. All conduit in general vicinity of fuel island shall be in compliance with NEC article 500,501,502, and NEC 514.
- 3.2 ADDITIONAL REQUIREMENTS FOR RIGID STEEL CONDUIT
- A. Rigid steel conduit shall be cut and threaded with tools accepted for the purpose and by qualified personnel.
    - 1. Accepted pipe vise.
    - 2. Roller/bade type cutter or band saw.
    - 3. Reamer capable of completely removing all ridges or burrs left by the cutter. Reaming with pliers is not acceptable.
  - B. Hangers shall be installed 8' apart.
  - C. Conduits stubbed through floor slabs, above grade and not contained inside walls, shall be rigid

galvanized metallic conduit.

3.3 ADDITIONAL REQUIREMENTS FOR EMT

- A. Electrical metallic tubing (thin wall) may be installed inside buildings above ground floor where not subject to mechanical injury.
- B. All cuts shall be reamed smooth and free of sharp and abrasive areas by use of an accepted reamer.

3.4 ADDITIONAL REQUIREMENTS FOR FLEXIBLE STEEL CONDUIT AND SEAL-TITE FLEXIBLE STEEL CONDUIT

- A. Shall be properly grounded.
- B. Shall be installed with accepted fittings.

3.5 ADDITIONAL REQUIREMENTS FOR RIGID NON-METALLIC CONDUIT (PVC CONDUIT)

- A. Rigid non-metallic PVC conduit is not allowed anywhere inside building(s) except underground, in slab, in poured in place concrete, and in block wall up to first outlet box (if not over 40" AFF) if allowed by codes. Rigid non-metallic PVC conduit may be used exterior to building as stated elsewhere in these specifications.
- B. Join rigid non-metallic conduit using cement as recommended by manufacturer. Wipe nonmetallic conduit dry and clean before joining. Apply full even coat of cement to entire area inserted in fitting. Allow joint to cure for 20 minutes, minimum.
- C. Threads will not be permitted on rigid non-metallic PVC conduit and fittings, except for rigid steel to rigid non-metallic PVC couplings.
- D. Installation of rigid non-metallic PVC conduit shall be in accordance with manufacturer's recommendations.
- E. Rigid non-metallic PVC conduit shall not be used to support fixture or equipment.
- F. Field bends shall be made with accepted hotbox. Heating with flame and hand held dryers are prohibited.

3.6 SUPPORTS

- A. Arrange supports to prevent misalignment during wiring installation.
- B. Support conduit using coated steel or malleable iron straps, lay-in adjustable hangers, clevis hangers, and split hangers.
- C. Group related conduits; support using conduit rack. Construct rack using steel channel; (minimum 24" increase distance as required) provide space on each for 25 percent additional conduits.
- D. Fasten conduit supports to building structure and surfaces under provisions of Section 16190 Hangers and Supports.
- E. Do not support conduit with wire, metal banding material, or perforated pipe straps. Remove wire used for temporary supports
- F. Do not attach conduit to ceiling support wires.
- G. Conduits shall not be supported from ceiling grid supports, plumbing pipes, duct systems, heating or air conditioning pipes, or other building systems.
- H. Non-bolted conduit clamps, as manufactured Caddy Corp. are not accepted. Supporting conduit and boxes with wire is not accepted. All raceways except those from surface-mounted switches, outlet boxes or panels shall be supported with clamp fasteners with toggle bolt on hollow walls, and with lead expansion shields on masonry.

### 3.7 EXPANSION FITTINGS

- A. Provide expansion fittings to accommodate expansion and deflection where conduit crosses control and expansion joints.
- B. Expansion fittings shall be installed in the following cases: 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; in each conduit run which mechanically attached to separate structures to relieve strain caused by shift on one structure in relation to the other; in straight conduit run above ground which is more than 100' long and interval between expansion fittings in such runs shall not be greater than 100'.

### 3.8 GROUNDING

- A. All raceways shall have a copper system ground conductor throughout the entire length of circuit installed within conduit in strict accordance with NEC codes.
- B. Grounding conductor shall be included in total conduit fill determining conduit sizes, even though not included or shown on Drawings.
- C. Grounding conductors run with exterior/ underground feeders shall be bare only.
- D. Grounding conductors run with feeders shall be bonded to portions of conduit that are metal by accepted ground bushings.
- E. See other sections of these specifications for additional requirements.
- F. Grounding conductors (including lightning protection down conductors) run in metal conduit shall be bonded to metal conduit at both ends.

### 3.9 FIRE AND SMOKE STOPPING

- A. Contractor is to provide fire stopping and/or smoke stopping for all penetrations of existing (or new if applicable) fire or smoke barrier walls, chases, floors, etc. as required to maintain existing rating of floor, wall, chase, etc.
- B. Install conduit to preserve fire resistance rating of partitions and other elements.
- C. Install fireproofing material to maintain existing rating of floor, beams, etc. damaged or removed by renovation.
- D. Fire and smoke stopping material: A two-part silicone foam or a one-part putty, UL classified and FM accepted with flame spread of 0 and smoke development not to exceed 50 in accordance with ASTM E84. Material shall be suitable for penetration seals through fire-rated floors and walls when tested in accord with ASTM E119. Material shall not melt or soften at high temperatures, shall be suitable for direct outdoor and ultraviolet exposures, shall cure to give a tight compression fit, and shall not produce toxic fumes. Material, when heated, shall expand to fill and hold penetration closed where burn out of cable insulation or ATC tubing occurs.

### 3.10 GENERAL

- A. Install conduit in accordance with NECA Standard Practice of Good Workmanship in Electrical Contracting. Contractor shall layout all work prior to rough-in.
- B. Install nonmetallic conduit in accordance with manufacturer's instructions.
- C. Arrange conduit to maintain headroom and present neat appearance.
- D. Route conduit installed above accessible ceilings or exposed to view parallel or perpendicular to walls. Do not run from point to point.
- E. Route conduit in and under slab from point-to-point.

- F. Do not cross conduits in slab.
- G. Maintain adequate clearance between conduit and piping.
- H. Maintain 12" clearance between conduit and surfaces with temperatures exceeding 104 degrees F (40 degrees C).
- I. Cut conduit square using saw or pipe cutter; de-burr cut ends.
- J. Bring conduit to shoulder of fittings; fasten securely.
- K. Use conduit hubs to fasten conduit to sheet metal boxes in damp and wet locations and to cast boxes.
- L. 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" size.
- M. Avoid moisture traps; provide junction box with drain fitting at low points in conduit system.
- N. Provide and install pullboxes, junction boxes, fire barrier at fire rated walls etc., as required by NEC 300, whether shown on Drawings or not.
- 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. Pullcord must be fastened to prevent accidental removal.
- P. Use suitable caps to protect installed conduit against entrance of dirt and moisture.
- Q. Grounding and bonding of conduit under provisions of Section 16170 Grounding and Bonding .
- R. Identify conduit under provisions of Section 16195 Identification for Electrical Systems.
- S. Install all conduits concealed from view unless specifically shown otherwise on Drawings
- T. Rigid steel box connections shall be made with double locknuts and bushings.
- U. All raceways shall be kept clear of plumbing fixtures to facilitate future repair or replacement of said fixtures without disturbing wiring. Except where it is necessary for control purposes, all raceways shall be kept away from items producing heat.
- V. 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.
- W. All raceways shall be run from outlet to outlet as shown on the Drawings, unless permission is granted to alter arrangement shown. If permission is granted arrangement shall be marked on field set of Drawings as previously specified.
- X. 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.
- Y. All conduit stubbed above floor shall be strapped to Kindorf channel supported by conduit driven into ground or tied to steel. 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."
- Z. All connections to motors or other vibrating equipment including dry type transformers or at other locations where required shall be made with not less than 12" of flexible steel conduit. Use angle connectors wherever necessary to relieve angle strain on flex conduit.
- AA. All connections to motors or other vibrating equipment including transformers or at other locations where required shall be made with not less than 12" of flexible liquid-tight steel conduit, with nylon



insulated throat connectors and wire mesh grip fittings (manufactured by Thomas & Betts or accepted equal) at both terminations of conduit. Use angle connectors wherever necessary to relieve angle strain on flex conduit.

- BB. Provide conduit seal-offs wherever conduit crosses obvious temperature changes (i.e. from inside to outside of coolers, freezers, etc.).
- CC. Route conduit through roof openings for piping and ductwork or through suitable roof flashing or boot. Coordinate location with roofing installation specified under other sections of these Specifications.
- DD. All raceways shall be run in neat and workmanlike manner and shall be properly in accordance with latest edition of NEC with accepted conduit clamps, hanger rods and structural fasteners.
- EE. 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.
- FF. 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.

END OF SECTION

SECTION 16123 - BUILDING WIRE AND CABLE

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 requirements for provision and installation of building wire and cable.
- B. Provide all equipment, labor, material, accessories, and mounting hardware to properly install all conductors and cables rated 600 volts and less for a complete and operating system for the following:
  - 1. Building wire and cable.
  - 2. Wiring connectors and connections.
- C. No aluminum wiring shall be permitted.
- D. All sizes shall be given in American Wire Gauge (AWG) or in thousand circular mils (MCM/kcmil).

1.3 REFERENCES

- A. ANSI/NFPA 70 National Electrical Code
- B. NEC 330
- C. UL 486A-486B

1.4 REGULATORY REQUIREMENTS

- A. Conform to requirements of ANSI/NFPA 70.
- B. Furnish products listed and classified by Underwriters Laboratories as suitable for purpose specified and shown.

1.5 SUBMITTALS

- A. Product Data: Submit catalog cut sheet showing, type and UL listing of each type of conductor, connector and termination.

1.6 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum five years experience.

1.7 PROJECT CONDITIONS

- A. Verify that field measurements are as shown on Drawings.
- B. Conductor sizes are based on copper.
- C. Wire and cable routing shown on Drawings is approximate unless dimensioned. Route wire and cable as required to meet project conditions.
- D. Where wire and cable routing is not shown, and destination only is indicated, determine exact routing and lengths required.

1.8 COORDINATION

- A. Determine required separation between cable and other work.
- B. Determine cable routing to avoid interference with other work.

## PART 2 - PRODUCTS

### 2.1 BUILDING WIRE AND CABLE

- A. Description: Single conductor insulated wire.
- B. Conductor: Copper.
- C. Insulation Voltage Rating: 600 volts.
- D. Insulation: ANSI/NFPA 70, Type THHN/THWN and XHHW.

## PART 3 - EXECUTION

### 3.1 GENERAL

- A. Install products in accordance with manufacturer's instructions.
- B. Conductors #10 AWG or #12 AWG shall be 600 volt type THWN/THHN unless noted otherwise, rated 90 degrees C. dry, 75 degrees C wet.
- C. Conductors #8 AWG and larger shall be Type THWN-2/THHN unless noted otherwise, rated 90 degrees C, wet or dry.
- D. Use solid conductor for feeders and branch circuits 10 AWG and smaller (except for control circuits).
- E. Use conductor no smaller than 12 AWG for power and lighting circuits.
- F. Neatly train and lace wiring inside boxes, equipment, and panelboards.
- G. All conductors shall be installed in raceway.
- H. Conductor sizes indicated on circuit homeruns or in schedules shall be installed over the entire length of the circuit, unless noted otherwise on the Drawings or in these Specifications.
- I. Before installing raceways and pulling wire to any mechanical equipment, verify electrical characteristics with final submittal on equipment to assure proper number and AWG of conductors. (As for multiple speed motors, different motor starter arrangements, etc.).
- J. Coordinate all wire sizes with lug sizes on equipment, devices, etc. Provide/install lugs as required to match wire size.
- K. Where oversized conductors are called for (due to voltage drop, etc.) provide/install lugs as required to match conductors, or provide/install splice box, and splice to reduce conductor size to match lug size.

### 3.2 EXAMINATION

- A. Verify that interior of building has been protected from weather.
- B. Verify that mechanical work likely to damage wire has been completed.

### 3.3 PREPARATION

- A. Completely and thoroughly swab raceway before installing wire.

### 3.4 WIRING METHODS

- A. Use only building wire type (THHN/THWN for #10 and #12 and THHN/THWN-2 for #8 and larger) insulation in raceway unless noted otherwise.
- B. Wiring in vicinity of heat producing equipment; use only XHHW insulation in raceway.
- C. Conductors installed within fluorescent fixture channels shall be Type THHN or XHHW rated 90 degrees C dry. Conductors for all other light fixtures shall have temperature ratings as required to meet the UL listing of the fixture; however, in no case shall the temperature rating be less

than 90 degrees C. Remove incorrect insulation types in new work.

### 3.5 INTERFACE WITH OTHER PRODUCTS

- A. Identify wire and cable under provisions of Section 16195 Identification for Electrical Systems.
- B. Identify each conductor with its circuit number or other designation indicated on Drawings.
- C. Identify neutrals with its associated circuit number(s).

### 3.6 FIELD QUALITY CONTROL

- A. Perform field inspection and testing under provisions of the General Requirements of the Contract Documents and Section 16090 Tests and Performance Verification of Electrical System.
- B. Inspect wire for physical damage and proper connection.
- C. Measure tightness of bolted connections and compare torque measurements with manufacturer's recommended values.
- D. Verify continuity of each branch circuit conductor.

### 3.7 PULLING

- A. No wire shall be pulled until the conduit system is complete from pull point to pull point and major equipment terminating conduits have been fixed in position.
- B. Mechanical pulling devices shall not be used on conductors sized #8 and smaller. Pulling means which might damage the raceway shall not be used.
- C. Use only powdered soapstone or other pulling lubricant acceptable to the A/E. Compound or lubricant shall not cause the conductor or insulation to deteriorate.
- D. All conductors to be installed in a common raceway shall be pulled together. The manufacturer's recommended pulling tensions shall not be exceeded.
- E. Bending radius of insulated wire or cable shall not be less than the minimum recommended by the manufacturer.
- F. Where communications type conductors are installed, special requirements shall apply as outlined under that specific system detail specifications.

### 3.8 CONTROL AND SIGNAL CIRCUITS

- A. For control and signal circuits above 50 VAC, conductors shall be #14 AWG minimum size Type XHHW or THWN-THHN as permitted by NFPA 70 within voltage drop limits, increased to #12 AWG as necessary for proper operation.
- B. For control and signal circuits 50 VAC and below, conductors, at the Contractor's option, may be #16 AWG, 300 volt rated, PVC insulated, except where specifically noted otherwise in the Contract Documents.
- C. Conductor insulation for fire alarm systems shall be as accepted by Code Inspection Authority only. Wire acceptance by the A/E shall not supersede this final acceptance for conditions of this specific project.
- D. Install circuit conductors in conduit.
- E. Circuit conductors to be stranded.

### 3.9 COLOR CODING

- A. All power feeders and branch circuits No. 6 and smaller shall be wired with color-coded wire with the same color used for a system throughout the building. Power feeders above No. 6 shall either be fully color-coded or shall have black insulation and be similarly color-coded with tape or

paint in all junction boxes and panels. Tape or paint shall completely cover the full length of conductor insulation within the box or panel.

- B. Unless otherwise accepted or required by A/E to match existing, color-code shall be as follows:  
Neutrals: 120/208V system white; 277/480V system natural gray  
Ground Wire: green, bare  
Isolated Ground Wire: green with yellow stripes  
120/208V: Phase A black, Phase B red, Phase C blue  
277/480V: Phase A brown, Phase B orange, Phase C yellow
- C. All switchlegs, other voltage system wiring, control and interlock wiring, shall be color-coded other than those noted above.

### 3.10 TAPS/SPLICES/CONNECTORS/TERMINATIONS

- A. Clean conductor surfaces before installing lugs and connectors.
- B. Make splices, taps, and terminations to carry full ampacity of conductors with no perceptible temperature rise.
- C. Power and lighting conductors shall be continuous and 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).
- D. Splices in lighting and power outlet boxes, wireway, and troughs shall be kept to a minimum. Pull conductors through to equipment, terminal cabinets, and devices.
- E. No splices shall be made in junction box or outlet boxes (wire No. 8 and larger) without written acceptance of Engineer.
- F. No splices shall be made in communications outlet boxes, pull boxes or wireways (i.e., fire alarm, computer, telephone, intercom, sound system, etc.) without written acceptance of Engineer. Pull cables through to equipment cabinets, terminal cabinets and devices.
- G. Allow adequate conductor lengths in all junction boxes, pull boxes and terminal cabinets. All termination of conductors in which conductor is in tension will be rejected and shall be replaced with conductors of adequate length. This requirement shall include the Contractor to provide sleeve type vertical cable supports in vertical raceway installations provided in pullboxes at proper vertical spacings.
- H. A calibrated torque wrench shall be used for all bolt tightening.
- I. Interior Locations:
  - 1. All (non-electronic systems) copper taps and splices in No. 8 or smaller shall be fastened together by means of "spring type" connectors. All taps and splices in wire larger than No. 8 shall be made with compression type connectors and taped to provide insulation equal to wire.
- J. Exterior Locations:
  - 1. Make splices, taps and terminations above grade in splice or termination cabinets. Do not splice any cable in ground or below finished grade.
  - 2. All taps and splices shall be made with compression type connectors and covered with Raychem heavywall cable sleeves (type CRSM-CT, WCSM or MCK) with type "S" sealant coating with sleeve kits as per manufacturer's installation instructions or be terminated/connected to terminal strips in above grade terminal boxes suitable for use.
  - 3. Provide and install above grade termination cabinets sized to meet applicable codes and standards, where required for splicing.

END OF SECTION

SECTION 16131 - OUTLET BOXES

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes wall and ceiling outlet boxes (and/or small junction/pullboxes).
- B. Provide and install all outlet boxes (flush or surface) complete with all accessories as required to facilitate installation of electrical system and as required by the NEC.

1.3 REFERENCES

- A. ANSI/NEMA FB 1 Fittings Cast Metal Boxes and Conduit Bodies for Conduit, Electrical Metallic Tubing and Cable
- B. ANSI/NEMA OS 1 Sheet-Steel Outlet Boxes, Device Boxes, Covers, and Box Supports
- C. ANSI/NFPA 70 National Electrical Code
- D. NEMA 250 Enclosures for Electrical Equipment (1000 Volts Maximum)

1.4 REGULATORY REQUIREMENTS

- A. Conform to requirements of ANSI/NFPA 70.
- B. Furnish products listed and classified by Underwriters Laboratories as suitable for purpose specified and shown.

1.5 SUBMITTALS

- A. Submit catalog cut sheets/product data on:
  - 1. Surface cast boxes.
- B. For pullboxes and junction boxes not covered in Section 16133 Pull and Junction Boxes, submit product data showing dimensions, covers, and construction.

1.6 PROJECT CONDITIONS

- A. Verify field measurements are as shown on Drawings.
- B. Verify locations of outlets in offices and work areas prior to rough-in.
- C. Electrical boxes are shown on Drawings in approximate locations unless dimensioned. Install at location required for box to serve intended purpose.

PART 2 - PRODUCTS

2.1 GENERAL

- A. All boxes and fittings shall be labeled by Underwriters Laboratories.
- B. Provide box accessories as required for each installation, including mounting brackets, wallboard hangers, extension rings, outlet boxes, and corrosion-resistant knockout closures compatible with outlet boxes being used and meeting requirements of individual wiring situations.
- C. All boxes shall be of the size and shape required by NFPA 70 for their respective locations.
- D. Boxes shall be of such form and dimensions as to be adapted to the specific use and location, type of device or fixtures to be used, and number and size of conductors and arrangement, size

and number of conduits connecting thereto.

- E. Handy boxes shall not be used.
- F. Outlet boxes to be one-piece.
- G. 4" x 4" boxes and 4 11/16" x 4 11/16" boxes used as junction boxes shall be one piece.

## 2.2 SHEET METAL OUTLET BOXES ANSI/NEMA OS 1, GALVANIZED STEEL:

- A. Luminaire and Equipment Supporting Boxes: Rated for weight of equipment supported; include 1/2" male fixture studs where required.
- B. Concrete Ceiling Boxes: Concrete type.
- C. Interior flush outlet boxes shall be galvanized steel constructed with stamped knockouts in back and sides, and threaded holes with screws for securing box coverplates or wiring devices. T&B, Steel City, Raco or accepted substitution.
- D. Ceiling outlet boxes shall be 4" octagonal or 4" square X 1-1/2" deep or larger as required for number and size of conductors and arrangement, size and number of conduits terminating at them.
- E. Switch, wall receptacle, telephone and other recessed wall outlet boxes in drywall shall be 4" square X 1-1/2" deep. For recessing in exposed masonry, provide one piece 4" square x 1-1/2" deep wall boxes with appropriate 4" square cut tile wall covers Steel City series #52-C-49/52-C-52 or accepted substitution. For recessing in furred-out block walls, provide 4" square box with required extension for block depth and required extension for drywall depth.

## 2.3 CAST BOXES NEMA FB 1:

- A. Interior surface outlet boxes and conduit bodies installed from 0" AFF to 90" AFF (including fire alarm device backbox) shall be the heavy cast aluminum or iron with external threaded hubs for power devices and threaded parts for low voltage devices; Appleton, Crouse Hinds or accepted substitution. Trim rings shall also be of one-piece construction.
- B. Weatherproof outlet boxes shall be constructed of corrosion-resistant cast metal suited to each application and having threaded conduit hubs, cast metal faceplate with spring-hinged waterproof cap suitably configured, gasket, and corrosion-proof fasteners.
- C. Boxes to be Type FD unless otherwise noted on drawings.
- D. Freestanding cast boxes are to be type FSY (with flange). Other cast zinc boxes are not acceptable.

## PART 3 - EXECUTION

### 3.1 GENERAL

- A. Install electrical boxes as shown on Drawings, and as required for splices, taps, wire pulling, equipment connections and compliance with regulatory requirements.
- B. Install electrical boxes to maintain headroom and to present neat mechanical appearance.
- C. Inaccessible Ceiling Areas: Install outlet and junction boxes no more than 6" from ceiling access panel or from removable recessed luminaire.
- D. Install boxes to preserve fire resistance rating of partitions and other elements.
- E. Align adjacent wall-mounted outlet boxes for switches, thermostats, and similar devices with each other.
- F. Use flush mounting outlet boxes in finished areas.
- G. Do not install flush mounting boxes back-to-back in walls; provide minimum 6" separation.

- Provide minimum 24" separation in acoustic rated walls.
- H. Secure flush mounting box to interior wall and partition studs. Accurately position to allow for surface finish thickness.
  - I. Use stamped steel bridges to fasten flush mounting outlet box between studs.
  - J. Install flush mounting box without damaging wall insulation or reducing its effectiveness.
  - K. Support all outlet boxes from structure with minimum of one 3/8" all-thread rod hangers. Boxes larger than 25 square inches shall be supported with two all-thread rod hangers, minimum.
  - L. Do not fasten boxes to ceiling support wires.
  - M. Support boxes independently of conduit.
  - N. Use gang box where more than one device is mounted together. Do not use sectional box.
  - O. Use gang box with plaster ring for single device outlets.
  - P. Use cast outlet box in exterior locations and wet locations.
  - Q. Comply with applicable portions of the NECA National Electrical Installation Standards.
  - R. Install outlets in the locations shown on the drawings; however prior to rough-in, the Owner shall have the right to make slight changes in locations to reflect room furniture layouts.
  - S. The Contractor shall coordinate his work with that of the General Contractor so that each electrical box is the type suitable for the wall or ceiling construction provided and suitable fireproofing is inbuilt into fire rated walls.
  - T. The Contractor shall relocate electrical boxes as required so that once installed, electrical devices will be symmetrically located with respect to the room layout.
  - U. All boxes shall be installed in a flush rigid manner with box lines at perpendicular and parallel angles to finished surfaces. Boxes shall be supported by appropriate hardware selected for the type of surface from which the box shall be supported. For example, provide metal screws for metal, wood screws for wood, and expansion devices for masonry or concrete.
  - V. For locations exposed to weather or moisture (interior or exterior), provide weatherproof boxes and accessories.
  - W. As a minimum, provide pull boxes in all raceways over 150'. The pull box shall be located near the midpoint of the raceway length.
  - X. Provide knockout closures to cap unused knockout holes where blanks have been removed, and plugs for unused threaded hubs.
  - Y. Provide conduit locknuts and bushings of the type and size to suit each respective use and installation.
  - Z. Boxes and conduit bodies shall be located so that all electrical wiring is accessible.
  - AA. Avoid using round boxes where conduit must enter box through side of box, which would result in a difficult and insecure connection with a locknut or bushing on the rounded surface.
  - BB. All flush outlets shall be mounted so that covers and plates will finish flush with finished surfaces without the use of shims, mats or other devices not submitted or accepted for the purpose. Add-a-Depth rings or switch box extension rings (Steel City #SBEX) are not acceptable. Plates shall not support wiring devices. Gang switches with common plate where two or more are indicated in the same location. Wall-mounted devices of different systems (switches, thermostats, etc.) shall be coordinated for symmetry when located near each other on the same wall. Outlets on each side of walls shall have separate boxes. Through-wall type boxes shall not be permitted. Back-to-back mounting shall not be permitted. Trim rings shall be extended to within 1/8" of



finish wall surface.

- CC. Outlet boxes mounted in metal stud walls are to be supported to studs with two 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 is finished.
- DD. All outlet boxes that do not receive devices in this Contract are to have blank plates installed matching wiring device plates.
- EE. Mount Height:
1. Height of wall outlets to bottom above finished floors shall be as follows, unless specifically noted otherwise, or unless otherwise required by applicable codes including ADA. Verify with the Architectural Drawings and Shop Drawings for installing:

Switches	4'-0" AFF to top
Receptacles	1'-4" AFF to bottom
Lighting Panels	6'-6" AFF to centerline of highest breaker/fuse
Phone outlets	1'-4" AFF to bottom
Fire Alarm Pull Stations	4'-0" AFF to top
Fire Alarm Strobe Lights	80" AFF to bottom
Thermostats	4'-0" AFF to top
Space Sensors	4'-0" AFF to top
  2. Bottoms of outlets above countertops or base cabinets shall be minimum 2" above countertop or backsplash, whichever is highest. Outlets may be raised so that bottom rests on top of concrete block course, but all outlets above counters in same area shall be at same height. It is the responsibility of this Division to secure cabinet drawings and coordinate outlet locations in relation to all cabinets as shown on Architectural Drawings, prior to rough-in, regardless of height shown on Division 16 Drawings.
  3. Height of wall-mounted fixtures shall be as shown on the drawings or as required by Architectural Drawings and conditions. Fixture outlet boxes shall be equipped with fixture studs when supporting fixtures.
- FF. Special Purpose Outlets:
1. Locate special purpose outlets as indicated on the Drawings for the equipment served. Location and type of outlets shall be coordinated with appropriate trades involved. The securing of complete information for proper electrical roughing-in shall be included as work required under this Section of Specifications. Provide plug for each outlet.
- GG. Outlets in Fire/Smoke and Smoke Partitions/Walls:
1. 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 in each framing space and that openings do not exceed 16 square inches. All clearances between such outlet boxes and the gypsum board must be completely filled with joint compound or other accepted materials. The wall must be built around outlets of larger size so as not to interfere with the integrity of the wall rating.

### 3.2 INTERFACE WITH OTHER PRODUCTS

- A. Coordinate installation of outlet box for products furnished under all Sections of these Specifications.
- B. Coordinate locations and sizes of required access doors with applicable Sections in these Specifications.
- C. Locate flush mounting box in masonry wall to require cutting of masonry unit corner only.

Coordinate masonry cutting to achieve neat opening.

- D. Coordinate mounting heights and locations of outlets mounted above counters, benches and backsplashes.
- E. Position outlet boxes to locate luminaires as shown on reflected ceiling plan.

### 3.3 ADJUSTING

- A. Adjust flush-mounting outlets to make front flush with finished wall material.
- B. Install knockout closure in unused box opening.

END OF SECTION

SECTION 16133 - PULL AND JUNCTION BOXES

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Provide and install pull and junction boxes as shown on Drawings or as required by the NEC.
- B. Provide and install pull and junction boxes wherever required for a complete and operating distribution system whether shown on Drawings or not.
- C. Where outlet boxes are used for pull and/or junction boxes, they shall meet the requirements of Section 16131 Outlet Boxes.

1.3 REFERENCES

- A. ANSI/NEMA FB 1 Fittings, Cast Metal Boxes and Conduit Bodies for Conduit, Electrical Metallic Tubing and Cable
- B. ANSI/NEMA OS 1 Sheet-Steel Outlet Boxes, Device Boxes, Covers, and Box Supports
- C. ANSI/NEMA OS 2 Nonmetallic Outlet Boxes, Device Boxes, Covers and Box Supports
- D. ANSI/NFPA 70 National Electrical Code
- E. NEMA 250 Enclosures for Electrical Equipment (1000 Volts Maximum)
- F. NEC Article 314 – Outlet, Device, Pull, and Junction Boxes: Conduit Bodies: Fittings: and Handhole Enclosures

1.4 REGULATORY REQUIREMENTS

- A. Conform to requirements of ANSI/NFPA 70.
- B. Furnish products listed and classified by Underwriters Laboratories as suitable for purpose specified and shown.

1.5 SUBMITTALS

- A. Submit actual shop drawings on all pull boxes showing.
  - 1. Covers.
  - 2. Dimensions - inside and out.
  - 3. Rating of concrete or gauge of metal.
  - 4. Manufacturer.
  - 5. Shop drawings indicating location and size of all inground pull boxes. Drawing shall include pull box designation (ie power, systems, etc), conduit size/quantity.

1.6 PROJECT RECORD DOCUMENTS

- A. Accurately record actual locations and mounting heights of pull and junction boxes.

1.7 PROJECT CONDITIONS

- A. Field verify any measurements shown on Drawings.

- B. Coordinate and verify locations of all pull and junction boxes prior to rough-in.
- C. Not all electrical boxes are shown on drawings. Boxes shown on drawings are in approximate locations only unless dimensioned. Install at location required for box to serve intended purpose while maintaining required access.

## PART 2 - PRODUCTS

### 2.1 GENERAL

- A. Dimensions of pull and junction boxes shall meet dimensions shown on Drawings or dimensions required by NEC, whichever is largest.
- B. Pull and junction boxes shall meet all requirements of UL and NEC.
- C. Small pull boxes (i.e. 4" x 4") shall meet the requirements of these Specifications for outlet boxes as a minimum.
- D. All boxes (above ground) of 100 cubic inches or more shall be constructed of 14 gauge steel with hot dip galvanized coating.

### 2.2 SHEET METAL BOXES

- A. NEMA OS 1, galvanized steel.
- B. Box to be fully weatherproof and watertight where installed outside.

### 2.3 SURFACE-MOUNTED CAST METAL BOX

- A. NEMA 250, Type 4; flat-flanged, surface-mounted junction box.
- B. Material: Cast aluminum.
- C. Cover: Furnish with ground flange, neoprene gasket, and stainless steel cover screws.
- D. Provide all hubs as required for conduit connections.

### 2.4 IN-GROUND PULL BOXES

- A. Material: Precast concrete, or composolite.
- B. Bottom: Open with 6" of gravel for drainage.
- C. Cover: Meet Florida Dept. of Transportation requirements for installed location, (pedestrian, heavy traffic, light traffic).
- D. Solid sides constructed to facilitate conduit entries.

## PART 3 - EXECUTION

### 3.1 GENERAL

- A. Install per NEC
- B. Install electrical boxes as shown on Drawings and as required for splices, taps, wire pulling, equipment connections and compliance with regulatory requirements.
- C. Install electrical boxes to maintain headroom and to present neat mechanical appearance.
- D. Install pull boxes and junction boxes above accessible ceilings and in unfinished areas only.
- E. Inaccessible Ceiling Areas: Install outlet and junction boxes no more than 6" from ceiling access panel or from removable recessed luminaire.
- F. Install boxes to preserve fire resistance rating of partitions and other elements.
- G. Align adjacent wall-mounted boxes with each other.
- H. Use flush mounting boxes in finished areas.

- I. Do not install flush mounting boxes back-to-back in walls; provide minimum 6" separation. Provide minimum 24" separation in acoustic rated walls.
- J. Secure flush mounting box to interior wall and partition studs. Accurately position to allow for surface finish thickness.
- K. Install flush mounting box without damaging wall insulation or reducing its effectiveness.
- L. Pull and junction boxes larger than 25 square inches shall be supported with two 3/8" all-thread rod hangers minimum.
- M. Install all labels and identification as required by the NEC and applicable sections of these Specifications.
- N. Pull and junction boxes used for systems (Sections 16700-16799) larger than 25 square inches shall be hinged cover type.
- O. Do not fasten boxes to ceiling support wires.
- P. Support boxes independently of conduit.
- Q. Large Pull Boxes:
  - 1. Boxes larger than 100 cubic inches in volume or 12" in any dimension.
    - a) Interior dry locations per NEC with screw covers.
  - 2. Other locations use hinged enclosure under provisions of Section 16160 Cabinets and Enclosures.
- R. Boxes Installed Outdoors: All boxes installed outdoors to be NEMA 4, fully weatherproof and watertight.
- S. In ground pull boxes shall be provided no further than 500' apart in a single/parallel run of conduit whether shown on drawings or not. Maximum distance of 500' shall be reduced when maximum pulling tension exceeds provided cable manufacturer's specified pulling tension.
- T. Unless otherwise noted interior power pull boxes shall be not be located more than 150' apart on a single/parallel run of conduit.

### 3.2 IN-GROUND PULL BOXES

- A. Provide and install ground rod in each pull box. Connect #2 copper ground wires (counterpoise) to ground rod, run out pullbox 6" over conduits to next pull box; tie to respective building electrical ground rod at each building.
- B. Install pull boxes flush with finished grade. Provide extensions as required.
- C. In-ground pullboxes to have interior watertight pull box mounted inside in-ground pull box as required by Local Authority Having Jurisdiction.

### 3.3 INTERFACE WITH OTHER PRODUCTS

- A. Coordinate locations and sizes of required access doors with applicable sections in these Specifications.
- B. Locate flush mounting box in masonry wall to require cutting of masonry unit corner only. Coordinate masonry cutting to achieve neat opening.

### 3.4 ADJUSTING

- A. Install knockout closure in unused box opening.

END OF SECTION

SECTION 16141 - WIRING DEVICES

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Provide and install all equipment, labor, material, accessories, and mounting hardware for a complete and operating system for the following:
  - 1. Wall switches.
  - 2. Receptacles.
  - 3. Device plates and decorative box covers.

1.3 REFERENCES

- A. NEMA WD 1 General Requirements for Wiring Devices
- B. NEMA WD 6 Wiring Devices Dimensional Specifications

1.4 REGULATORY REQUIREMENTS

- A. Conform to requirements of ANSI/NFPA 70.
- B. Furnish products listed and classified by Underwriters Laboratories as suitable for purpose specified and shown.

1.5 SUBMITTALS

- A. Product Data: Provide manufacturer's catalog information showing dimensions, colors, and configurations.
  - 1. Submit product data on all types of wiring devices including plates and engraving.
- B. Manufacturer's Instructions:
  - 1. Indicate application conditions and limitations of use stipulated by product testing agency specified under regulatory requirements.
  - 2. Include instructions for storage, handling, protection, examination, preparation, operation and installation of product.

1.6 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum five years experience.

1.7 EXTRA MATERIALS

- A. Provide a minimum of two screwdrivers of each type of tamper proof screw used on project.
- B. Turn over to Owner and submit Spare Parts Certification receipt. (See Section 16098 Operation and Maintenance Manuals).

PART 2 - PRODUCTS

2.1 GENERAL

- A. All devices shall be Specification Grade as minimum.
- B. General purpose wiring devices shall meet NEMA standard WD-1, Wiring Devices, General Purpose. Special purpose devices shall conform to the requirements of NEMA standard WD-5,

Wiring Devices, Special Purpose.

- C. All wiring devices shall bear UL labels.
- D. All devices of one type (i.e. all snap switches, all duplex receptacles, etc.) shall be by the same manufacturer. Hazardous Location and Special Purpose Devices may not be available from the same manufacturer; this shall constitute the only exception to this requirement of single-source.
- E. Corrosion resistant devices shall be as specified for normal usage, and fabricated of yellow color melamine plastic. Where "Weatherproof" type is indicated for exterior or wet locations, provide matching self-closing cover with gasketed seals at plate/wall junctions and for cover.
- F. Provide factory packaged wiring devices having high impact strength molded plastic bodies.
- G. Except where specifically required in these Specifications, use of interchangeable type or combination switch-receptacle-pilot devices is not acceptable and shall be removed.
- H. Switches and receptacles connected to the emergency power system shall be red. Plates shall be as specified for devices connected to normal circuits, but shall be engraved reading "Emergency", see Drawings for other engraving requirements.

## 2.2 WALL SWITCHES

- A. Manufacturers:
  - 1. See Drawings.
- B. General:
  - 1. Snap switches for general use shall be maintained contact types, and shall be single-pole, double-pole, three-way, or four-way as required for the specific switching arrangements shown on the Drawings. They shall be quiet tumbler operation types, having silver alloy contacts, and meeting all NEMA performance standards. Color to match plates unless specifically noted otherwise in Specifications and/or on Drawings.
  - 2. Switches shall be toggle or key-operated types, as indicated on the Drawings. All key-operated switches shall be keyed alike.
  - 3. Where switches are denoted as having pilot lights, pilot lights shall glow when the switches are "On". Provide pilot light switch with lamp and miniature step-down transformer. The pilot light shall have a red lens, and the lamp shall be long-life type.
  - 4. Jewels for use with switches controlling motors shall be green, and jewels for other purposes shall be amber. All units shall be front re-lampable.
  - 5. Snap switches installed in hazardous locations shall be UL listed for the type of location (class and division).
  - 6. Switches connected to the branch of the emergency distribution system emergency power shall have red lighted handles which shall illuminate when the switches are Off.
  - 7. Voltage and ampere rating of switches shall be marked on switch, and shall conform to voltage of system to which applied.
- C. Description: NEMA WD 1, heavy-duty, ac only general-use snap switch.
- D. Voltage Rating: 120-277 volts, ac.
- E. Current Rating: 20 amperes minimum.
- F. Ratings: Match branch circuit and load characteristics.

## 2.3 WALL DIMMERS

- A. Manufacturers:

1. See Drawings.
- B. Description: NEMA WD 1, semiconductor dimmer for incandescent lamps, type as indicated on Drawings.
- C. Device Body: Plastic with rotary knob or linear slide as called for on Drawings.
- D. Voltage: 120/277 volts or as required to match application.
- E. Power Rating: Match load shown on Drawings; 600 Watts minimum.
- F. Accessory Wall Switch: Match dimmer appearance.
  1. Same manufacturer and style as dimmer switch.

#### 2.4 RECEPTACLES

- A. General:
  1. All receptacles shall be of standard NEMA configuration, as indicated on the Drawings, and shall comply with the respective ANSI C73 series standard for the NEMA configuration. Color to match plates unless specifically noted otherwise in specifications and/or on Drawings.
  2. Duplex receptacles shall have integral UL listed self-grounding clips. Similar, single receptacles shall be provided for plug-in connections of industrial fluorescent light fixtures on the same switching circuit. Receptacle face to be impact resistant nylon.
  3. Weatherproof duplex receptacles shall be provided in all exterior locations, and shall be ground fault circuit Interrupting (GFCI) types, with weatherproof cover plates allowing use of receptacle with cover in closed position.
  4. Special purpose receptacles for specific equipment shall be grounding types, having the number of poles, voltage and ampere ratings, and NEMA configurations required by the equipment. For each special purpose receptacle, provide an identical mating plug equipped with cord grip, secured to cord.
  5. Duplex receptacles shall have back and side wired screw pressure terminals.
- B. Description: NEMA WD 1; heavy-duty general use receptacle.
- C. Configuration: NEMA WD 6; heavy-duty, general use type as specified and indicated.
- D. Convenience Receptacle: Type 5-20.
- E. GFCI Receptacle: Convenience receptacle with integral ground fault circuit interrupter to meet regulatory requirements.
- F. Manufacturers:
  1. See Drawings.

#### 2.5 COVER PLATES

- A. All wiring devices shall be provided with standard size one-piece cover plates of suitable configuration for the number and type of devices to be covered.
- B. Metallic cover plates shall be used in interior spaces, except as noted below, and shall be fabricated of corrosion-resistant #302 stainless steel having a nominal thickness of .04" and a brushed finish. Screws securing the plates shall have flush (when installed) heads with finish to match plates. Metallic cover plates shall meet all requirements of the National Electrical Code and Federal Specifications.
- C. Where so directed by the A/E (either by Contract Documents or direction after the bid) substitute nylon plates of quality as specified below, without increase in Contract Price. Coordinate prior to



securing plates for project. Where nylon cover plates are required in finished interior spaces, these shall be fabricated of either non-combustible mar-proof high impact resistant fiberglass or nylon reinforced thermosetting material or nylon, having a minimum thickness of .10", with smooth finish. Screws securing the plates shall have flush (when installed) heads of color to match plates. Nylon cover plates shall conform to Federal Specification QP-455A and all other NEC, UL and NEMA requirements. Where required by A/E nylon plates shall be fitted with nylon screws for totally nonmetallic surface installation.

- D. 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 presswitch.
- E. Cover plates for exterior receptacles shall be gasketed covers with hinge allowing plug and cord to be plugged in and activated with cover closed..
- F. Cover plate engraving, where required, shall be accomplished by cover plate manufacturer in accordance with instructions given on the Drawings. Metallic plates and nylon plates in ivory, beige, gray, and white shall be engraved with black fill. Red, brown, and black nylon plates shall be engraved with white fill.
- G. Unless specifically noted otherwise in Specifications or on Drawings, all outlets for telephone and other communications and data systems shall be provided with standard size one-piece cover plates having a minimum 3/4" diameter bushed hole in the center unless specifically noted otherwise in Specifications and/or on Drawings. Where telephone conductors are installed, plates shall contain telephone type, polarized plug-in receptacles.
- H. All device plates (including systems device plates and trims) and blank plates located in all secure areas shall be mounted with tamper proof screws, unless otherwise noted.

## 2.6 COLOR

- A. Wiring devices connected to normal power and located in unfinished spaces shall be grey color. Devices connected to normal power and located in finished interior spaces shall be of color selected by Architect from the following list of standard colors: ivory, beige, gray, white, brown, black.
- B. Cover plates for devices connected to normal power and located in finished interior spaces shall be of color selected by Architect from the above list of standard colors or #302 stainless steel.
- C. All devices and coverplates in paneled walls shall have finish to match paneling.
- D. Devices connected to the emergency distribution system emergency power shall be red color, except where established building standards and/or isolated ground devices require otherwise. Coordinate before purchase.
- E. Contractor shall modify any given catalog numbers as required to procure devices and plates of the proper color.

## 2.7 FLUORESCENT DIMMERS

- A. Dimmers shall be electronic type equal to type specified on drawings. Dimmers shall be complete including remote control where required. Special dimming ballasts shall be included on fixtures to be dimmed. Ballasts shall be approved by the dimmer manufacturer.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Verify conditions under provisions of Division 1 General Requirements and any other applicable supplemental requirements/conditions.
- B. Verify outlet boxes are installed at proper height.

- C. Verify wall openings are neatly cut and will be completely covered by wall plates.
- D. Verify floor boxes are adjusted properly.
- E. Verify branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.

### 3.2 PREPARATION

- A. Provide extension rings to bring outlet boxes flush with finished surface.
- B. Clean debris from outlet boxes.

### 3.3 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Install devices plumb and level.
- C. Install switches with OFF position down.
- D. Install wall dimmers to achieve full rating specified and indicated after derating for ganging as instructed by manufacturer.
- E. Do not share neutral conductor on load side of dimmers.
- F. Install receptacles with grounding pole on bottom.
- G. Install decorative plates on switch, receptacle, and blank outlets in finished areas.
- H. Electrical boxes shall be cleaned and completely free of any debris, dust, etc. prior to the installation of wiring devices.
- I. Where two or more switches or receptacles are to be installed adjacent to one another, provide a multi-gang box and combination multi-gang coverplate. Provide proper NEC barriers in boxes which serve devices for both the Normal and Emergency Systems.
- J. Provide device coverplates for every device installed. Cover plates shall be installed so that they appear straight with no gaps between plate edges and the wall. Maintain vertical and horizontal to within 1/16 of an inch.
- K. In finished areas provide same type of plate for all surface mounted devices as for recessed mounted devices.
- L. In any room where new and existing construction is present, all receptacles, switches, and coverplates which are existing to remain shall be changed as required to match new work.
- M. Wiring devices shall not be installed in exposed masonry until cleaning of masonry with acids has been completed.
- N. All receptacles and switches shall be grounded by means of a ground wire from device ground screw to outlet box screw and branch circuit ground conductor. Strap alone will not constitute an acceptable ground.
- O. All wiring devices, relays, contactors, pushbuttons, selector switches, pilot lights, etc. shall be installed in approved enclosures rated for the appropriate NEMA classified environment.
- P. All devices shall be installed so that only one wire is connected to each terminal.
- Q. Once construction is substantially completed, replace all damaged, burned, or scorched wiring devices.
- R. Receptacles shown to be floor mounted shall be installed in floor boxes (with coverplates) which are approved for this use.
- S. Connect wiring devices by wrapping conductor around screw terminal.

- T. Install protective rings and split nozzle on active flush cover service fittings.
- U. Install local room area wall switches at door locations on the lock side of the door approximately four inches from the jamb. Where locations shown on the Drawings are in question, provide written request for information to A/E prior to rough-in.

#### 3.4 NEUTRAL CONDUCTOR CONNECTIONS

- A. Each receptacle's "in" and "out" phase and neutral conductors shall have an additional conductor for connection to device. The practice of "looping" conductors through receptacle boxes shall not be acceptable.

#### 3.5 INTERFACE WITH OTHER PRODUCTS

- A. Coordinate locations of outlet boxes provided under other Sections of these Specifications to obtain mounting heights specified and indicated on Drawings.

#### 3.6 FIELD QUALITY CONTROL

- A. Inspect each wiring device for defects.
- B. Operate each wall switch with circuit energized and verify proper operation.
- C. Verify that each receptacle device is energized.
- D. Test each receptacle device for proper polarity.
- E. Test each GFCI receptacle device for proper operation.

#### 3.7 ADJUSTING

- A. Adjust devices and wall plates to be flush and level.

END OF SECTION

SECTION 16160 - CABINETS AND ENCLOSURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Provide and install all equipment, labor, material, accessories, and mounting hardware for a complete and operating system for the following:
  - 1. Hinged cover enclosures.
  - 2. Cabinets.
- B. Cabinets and enclosures are to include:
  - 1. Terminal blocks.
  - 2. Mounting panel.
  - 3. Ground bus/bar.
  - 4. All accessories as required for a complete and operating system.
- C. Provide and install cabinets and enclosures as specified herein for all systems specified in Division 16 Specifications (including Sections 16700 - 16799) and Division 17 when included in Specifications.

1.3 REFERENCES AND REGULATORY REQUIREMENTS

- A. Conform to the requirements of the following:
  - 1. NEMA 250 Enclosures for Electrical Equipment (1000 Volts Maximum)
  - 2. NEMA ICS 4 Terminal Blocks
  - 3. ANSI/NFPA 70 National Electrical Code
- B. Furnish products listed and classified by Underwriters Laboratories as suitable for purpose specified and shown.

1.4 SUBMITTALS

- A. Submit Product Data: Provide manufacturer's standard data for enclosures and cabinets.
- B. Submit Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency specified under "References and Regulatory Requirements." Include instructions for storage, handling, protection, examination, preparation, installation, and starting of product.
- C. Submit actual shop drawings on all cabinets and enclosures showing:
  - 1. Covers.
  - 2. Dimensions - inside and out.
  - 3. Gauge of metal.
  - 4. Manufacturer.
  - 5. Terminal mounting plate, construction, etc.
  - 6. Ground bus/bar.

1.5 EXTRA MATERIALS

- A. Provide two of each cabinet key.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Unless specifically called for otherwise on Contract Drawings, provide cabinets as specified herein for terminal cabinets mounted indoors. Similarly, provide hinged cover enclosures as specified herein for terminal cabinets mounted outdoors or in locations other than NEMA 1 locations. Also provide hinged cover enclosures for locations where size required is not available in cabinet construction, or if specifically specified as enclosure in Contract Documents.
- B. Size:
1. Dimensions of cabinets and enclosures shall meet the dimensions shown on Drawings, dimensions required by NEC, or dimensions sized as required to facilitate all equipment/connections involved installation, whichever is largest.
  2. Coordinate with Sections 16700 through 16799, Section 16691 Surge Protective Devices, (if included, Division 17 of these Specifications to assure that size of equipment cabinet or enclosure will house and facilitate proper installation and access to equipment, to be installed/mounted in cabinet or enclosure.
- C. Provide metal barriers to separate compartments containing control wiring operating at less than 50 volts from power wiring.
- D. Provide accessory feet and/or mounting brackets for free-standing equipment.
- E. Cabinets and enclosures installed outdoors shall be fully weatherproof and watertight.

2.2 HINGED COVER ENCLOSURES

- A. Construction:
1. Interior Locations: NEMA Type 1 steel (unless otherwise noted).
  2. Exterior Locations: NEMA Type 4X:
    - a) Within 10 Miles of Ocean or Gulf: Stainless steel or fiberglass.
    - b) Other Exterior Locations: Primed and phosphatized steel.
- B. Covers: Continuous hinge.
- C. Enclosure Finish:
1. NEMA 1:
    - a) Manufacturer's standard metallic gray enamel over phosphatized surfaces.
  2. NEMA 4X:
    - a) Within 10 Miles of Ocean or Gulf: Stainless steel or gray gel coat on fiberglass.
    - b) Other Exterior Locations: Epoxy painted.
- D. Lock/Handle:
1. Provide/install key lock handle on all enclosures mounted in rooms/areas/spaces that are not electrical rooms or mechanical rooms. Enclosures installed in electrical rooms need not be and are not required to be lockable.
- E. Interior Mounting Plate:
1. Each enclosure is to have interior mounting plate/panel for mounting terminal blocks and

electrical components.

2. Plate/panel is to be metal.
- F. Ground Bus/Bar:
1. Each enclosure housing surge suppression equipment or other equipment shall have local ground bar/bus installed. See "Local Ground Bus/Bar" below.
- G. Manufacturers:
1. Hoffman.
  2. Electromate Corporation.
  3. Carlon for NEMA 4X.

## 2.3 CABINETS

- A. Construction: Code gauge steel with removable endwalls.
- B. Finish:
1. Boxes: Galvanized steel.
  2. Fronts: Gray baked enamel.
- C. Fronts:
1. Electrical or Mechanical Room Locations: Screw cover with flush handle or as noted below.
  2. Other Locations: mono-flat with concealed trim clamps, concealed hinges, and flush lock lockable handle.
  3. Flush or surface type as shown or called for in Contract Documents.
- D. Interior Mounting Plate:
1. Each enclosure is to have interior mounting plate/panel for mounting terminal blocks and electrical components.
  2. Panel/plate may be constructed of wood if painted with fire retardant paint of a flame spread rating of Class A, if it meets all applicable codes, and it is acceptable to the Authority Having Jurisdiction; otherwise plate to be metal.
  3. Panel/plate shall be metal.
- E. Ground Bus/Bar:
1. Each cabinet housing surge suppression equipment or other equipment shall have local ground bar/bus installed. See "Local Ground Bus/Bar" below.
- F. Manufacturer:
1. Sq. "D" Class 6650 Series.

## 2.4 TERMINAL BLOCKS

- A. Terminal Blocks: ANSI/NEMA ICS 4.
- B. Power Terminals: Unit construction type with closed back and tubular pressure screw connectors, rated 600 volts.
- C. Signal and Control Terminals: Modular construction type suitable for channel mounting, with tubular pressure screw connectors rated 300 volts.
- D. Provide ground bus terminal block with each connector bonded to enclosure.

2.5 LOCAL GROUND BUS/BAR

- A. Size to handle #6 through #14 AWG copper ground wire.
- B. Length as required for circuits.
- C. Manufacturer:
  - 1. Sq. "D" #PK\*\*\*GTA Series.

PART 3 - EXECUTION

3.1 EXAMINATION

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

3.2 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Install enclosures and cabinets plumb. Anchor securely to wall and structural supports at each corner.
- C. Install cabinet fronts plumb.
- D. Install per NEC and as required for proper clearance. Coordinate with panels.
- E. Provide and install terminal cabinets as shown on Drawings or as required by the NEC.
- F. Provide and install terminal cabinets wherever required for a complete and operating distribution system whether shown on Drawings or not.
- G. Install local ground bus/bar in each terminal cabinet/enclosure that houses surge protective devices or other equipment and bond to cabinet enclosure via mounting screws or #6 AWG copper ground wire.
- H. Ground local ground bus to systems ground bus/bar with minimum #6 AWG copper ground wire. Increase size if so required on Drawings.
- I. Install all labels and identification as required by the NEC and applicable sections of these Specifications.

END OF SECTION

SECTION 16170 - GROUNDING AND BONDING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes
  - 1. Grounding electrodes and conductors.
  - 2. Equipment grounding conductors.
  - 3. Bonding.
  - 4. Counterpoise System.
- B. Provide all labor, materials, and equipment necessary to properly install a grounding system conductor in all new branch wiring and feeder installations, which shall be in full compliance with all applicable codes as accepted by the Authorities Having Jurisdiction. The secondary distribution system shall include a grounding conductor in all raceways in addition to the return path of the metallic conduit.
- C. In general, all electrical equipment (metallic conduit, motor frames, panelboards, etc.) shall be bonded together with a green insulated or bare copper system grounding conductor in accordance with specific rules of NEC 250, and state codes. Bonding conductor through the raceway system shall be continuous from main switch ground bus to panel ground bar of each panelboard, and from panel grounding bar of each panelboard to branch circuit equipment and devices.
- D. All raceways shall have an insulated copper system ground conductor throughout the entire length of circuit installed within conduit in strict accordance with NEC. Grounding conductor shall be included in total conduit fill determining conduit sizes, even though not included or shown on drawings. Grounding conductors that run with feeders in PVC conduit outside of building(s) shall be bare only.
- E. Provide and install all grounding and bonding as required by the National Electrical Code (NEC) including but not limited to NEC 250.

1.3 REFERENCES

- A. ANSI/NFPA 70 National Electrical Code
- B. NFPA 780 Standard for the Installation of Lightning Protection Systems
- C. UL 467 Grounding and Bonding Equipment

1.4 REGULATORY REQUIREMENTS

- A. Conform to requirements of ANSI/NFPA 70.
- B. Furnish products listed and classified by Underwriters Laboratories as suitable for purpose specified and shown.

1.5 SUBMITTALS

- A. Submit catalog cut sheets/product data on:
  - 1. Ground rods and couplings.
  - 2. Mechanical connectors.
  - 3. Ground wells.



4. Ground bus bars and associated components.
  5. Counterpoise conductor.
  6. Exothermic welding materials and molds.
  7. Testing equipment and procedures.
- B. Product data shall prove compliance with specifications, National Electrical Code, manufacturers' specifications, and written installation data.

#### 1.6 PROJECT RECORD DOCUMENTS

- A. Submit record documents to accurately record actual locations of grounding electrodes.
- B. Submit test results of each ground rod. See Section 16090 Tests and Performance Verification of Electrical System.

### PART 2- PRODUCTS

#### 2.1 ROD ELECTRODE

- A. Material: Copper-clad steel.
- B. Diameter: 5/8".
- C. Length: 30' (minimum). Increase lengths as required to meet and achieve specified resistance.

#### 2.2 MECHANICAL CONNECTORS

- A. All grounding connectors shall be in accordance with UL 467 and UL listed for use with rods, conductors, reinforcing bars, etc., as appropriate.
- B. Connectors and devices used in the grounding systems shall be fabricated of copper or bronze materials, and properly applied for their intended use. Specified items of designated manufacturers indicate required criteria. Equal products may be provided if approved. All connectors and devices shall be compatible with the surfaces being bonded and shall not cause galvanic corrosion by dissimilar metals. Materials in items not listed herein shall be of equal quality to the following specified items:
  1. Lugs: Substantial construction, of cast copper or cast bronze, with "ground" (micro-flat) surfaces, twin clamp, two-hole tongue, equal to Burndy QQA Series or T&B equal. Lightweight and "competitive" devices shall be rejected.
  2. Grounding and Bonding Bushings: Malleable iron, Thomas and Betts (T&B), or equal.
  3. Piping Clamps: Burndy GAR-TC Series with two hole compression terminal or T&B equal.
  4. Grounding Screw and Pigtail: Raco No. 983 or equal.
  5. Building Structural Steel, Existing: Thompson 701 Series heavy duty bronze "C" clamp with two-bolt vise-grip cable clamp.
- C. Mechanical lugs or wire terminals shall be used to bond ground wires together or to junction boxes and panel cabinets and shall be manufactured by Anderson, Buchanan, Thomas and Betts Co., or Burndy.

#### 2.3 WIRE

- A. Material: Stranded copper.
- B. Size: Size to meet NFPA 70 requirements as a minimum, increase size if called for on Drawings, in these specifications, or as required for voltage drop.
- C. Insulated THWN (or bare as noted elsewhere).

#### 2.4 GROUNDING WELL COMPONENTS

- A. Grass Non-Traffic Areas:
    - 1. Well: Sleeve 18" long, diameter 12" (minimum).
    - 2. Well Cover: High-density plastic, composolite, or cast iron with legend "GROUND" embossed on cover.
    - 3. Material: Structural Plastic, composolite, or concrete.
    - 4. Manufacturer: Carson 2200 Series or equal by Quazite.
    - 5. Increase depth, diameter or size as required to provide proper access at installed location.
  - B. Paving and Low Traffic Areas:
    - 1. Well: Minimum 12" long by 12" wide by 18" deep with open bottom.
    - 2. Well Cover: Traffic rated for use with "GROUND" embossed on cover.
    - 3. Material: Composolite.
    - 4. Manufacturer: Quazite.
    - 5. Increase depth, diameter or size as required to provide proper access at installed location.
- 2.5 GROUNDING BARS/GROUND BUS (INCLUDING SYSTEMS GROUND BUS/BARS AND GROUND BUS BARS)
- A. Ground bars shall be copper of the size and description as shown on the Drawings. If not sized on Drawings, bus bar shall be minimum 1/4" x 2" bus grade copper, spaced from wall on insulating 2" polyester molded insulator standoff/supports, and be 12" or greater minimum overall length, allowing 2" length per lug connected thereto. Increase overall length as required to facilitate all lugs required while maintaining 2" spacing. Size of bus bar used in main electrical room shall be similar except minimum of 4" high and 24" long.
  - B. Provide bolt-tapping lug with two hex head mounting bolts for each terminating ground conductor, sized to match conductors. Mount on bus bar at 2" on center spacing. Lugs to be manufactured by Burndy or T&B.
  - C. Standoff supports to be 2" polyester as manufactured by Glastic No. 2015-4C.

### PART 3 - EXECUTION

#### 3.1 GENERAL

- A. Install products in accordance with manufacturer's instructions.
- B. Install grounding electrodes conductor, bonding conductors, ground rods, etc. with all required accessories.
- C. Grounding shall meet (or exceed as required to meet these specifications) all the requirements of the NEC, the NFPA, and applicable standards of IEEE.
- D. Where there is a conflict between these specifications and the above applicable codes/standards, or between this section of these specifications and other sections, then the most stringent or excessive requirement shall govern. Where there is an omission of a code/standard requirement in these specifications then the code/standard requirements shall be complied with.
- E. Requirement in these specifications to comply with a specific code/standard article, etc. is not to be construed as deleting of requirements of other applicable codes/standards and their articles, etc.

#### 3.2 GROUNDING ELECTRODES

- A. All connections shall be exothermic welded unless otherwise noted herein. All connections above grade and in accessible locations may be by exothermic welding or by braising or clamping

with devices UL listed as suitable for use except in locations where exothermic welding is specifically specified in these specifications or called for on Drawings.

- B. Each rod shall be die stamped with identification of manufacturer and rod length.
- C. Install rod electrodes at locations indicated and/or as called for in these Specifications.
- D. Ground Resistance:
  - 1. Main Electrical Service (to each building) and Generator Locations:
    - a) Grounding resistance measured at each main service electrode system and at each generator electrode system shall not exceed 5 ohms.
  - 2. Other Locations:
    - a) Resistance to ground of all non-current carrying metal parts shall not exceed 5 ohms measured at motors, panels, buses, cabinets, equipment racks, light poles, transformers, and other equipment.
    - b) Lightning Protection system ground locations shall not exceed 5 ohms for the Franklin system measured at ground electrode.
  - 3. Resistance called for above shall be maximum resistance of each ground electrode prior to connection to grounding electrode conductor. Where ground electrode system being measured consists of two or more ground rod electrodes then the resistance specified above shall be the maximum resistance with two or more rods connected together but not connected to the grounding electrode conductor.
- E. Install additional rod electrodes as required to achieve specified resistance to ground (specified ground resistance is for each ground rod location prior to connection to ground electrode conductor). Depending on soil condition, etc. of ground rod locations, it has been found that the ground rod lengths required to achieve the specified resistance may range from the minimum specified length to up to 80' or more in length.
- F. Provide grounding well with cover at each rod location. Install grounding well top flush with finished grade.
- G. Verify that final backfill and compaction has been completed before driving rod electrodes.
- H. Install ground rods not less than 1' below grade level and not less than 2' from structure foundation.

### 3.3 GROUNDING ELECTRODE CONDUCTOR

- A. Conductor shall be sized to meet (or exceed as required to meet these Specifications and/or Drawings) the requirements of NEC 250.

### 3.4 EQUIPMENT GROUNDING CONDUCTORS

- A. Grounding conductors shall be provided with every circuit to meet (or exceed as required to meet these Specifications and/or Drawings) the requirements of NEC 250.
- B. At every voltage level, new portions of the electrical power distribution system shall be grounded with a dedicated copper conductor, which extends from termination back to power source in supply panelboard.
- C. Provide separate, insulated (bare if with feeder in PVC conduit outside of building(s)) conductor within each feeder and branch circuit raceway. Terminate each end on suitable lug, bus, or bushing.
- D. Except as otherwise indicated, each feeder raceway on the load side of the service entrance shall contain a ground conductor sized as indicated and where not shown shall be sized to meet (or exceed as required to meet these specifications and/or drawings) the requirements of NEC 250.

Conductor shall be connected to the equipment grounding bus in switchboards and panelboards, to the Grounding Bus in all motor control centers, and as specified, to lighting fixtures, motors and other types of equipment and outlets. The ground shall be in addition to the metallic raceway and shall be properly connected thereto, using a lug device located within each item enclosure at the point of electric power connections to permit convenient inspection.

- E. Provide green insulated ground wire for all grounding type receptacles and for equipment of all voltages. In addition to grounding strap connection to metallic outlet boxes, a supplemental grounding wire and screw equal to Raco No. 983 shall be provided to connect receptacle ground terminal to the box.
- F. All 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.
- G. Where integral grounding conductor is specified elsewhere in bus duct construction, provide equivalent capacity conductor from supply switchboard or panelboard grounding bus to the bus duct grounding conductor. Bond integral conductor to bus duct enclosure at each tap and each termination.
- H. All motors, all heating coil assemblies, and all building equipment requiring flexible connections shall have a green grounding conductor properly connected to the frames and extending continuously inside conduit with circuit conductors to the supply source bus with accepted connectors regardless of conduit size or type. This shall include Food Service equipment, Laundry equipment, and all other "Equipment By Owner" to which an electric conduit is provided under this Division.

### 3.5 MAIN ELECTRICAL SERVICE

- A. Complete installation shall meet and exceed the requirements of the NEC 250.
- B. Artificial electrodes shall be provided for the main service in sufficient number and configuration to secure resistance specified.
- C. Provide and bond to all of the following:
  - 1. Ground rods.
  - 2. Metal water pipe (interior and exterior to building).
  - 3. Building metal frame, structural steel and/or reinforced structural concrete.
  - 4. All piping entering or leaving all buildings (including chilled water piping).
  - 5. Encased Electrodes.
  - 6. Site distribution counterpoise ground system.
  - 7. Lightning protection system.
- D. A main ground, bare copper conductor, sized per applicable table in NEC 250, but in no case less than #2/0, shall be run in conduit from the main switchgear of each building to the building steel in respective building. This ground conductor shall also be run individually from the main switchgear and be bonded to the main water service ahead of any union in pipe and must be metal pipe of length and location as acceptable by authorities having jurisdiction. Provide properly sized bonding shunt around water meter and/or dielectric unions in the water pipe. Also required is the same size ground wire to ground rod electrode as called for below:
  - 1. Three 30' ground rods in a delta configuration at no less than 30' spacing driven to a minimum depth of 30' plus 1' below grade.
  - 2. Bond ground rod electrodes together with a bare copper ground conductor that matches size required by applicable table in NEC 250, but in no case less than #2/0.

3. Provide additional rod electrodes as required to achieve specified ground resistance.
- E. Ground/bond neutral per NEC 250.
- F. A main ground, bare copper conductor, sized per applicable table in NEC 250, but in no case less than #2/0, shall be run in conduit from the main switchgear of each building to a concrete encased electrode per NEC 250.52(A)(3).
- G. Bond grounding electrodes to site counterpoise grounding system and lightning protection system where provided.
- H. Provide and install ground bus bar on wall near main service disconnect/switchboard. Connect to ground bar in disconnect/switchboard bonded to switchboard/disconnect enclosure/neutral with copper grounding conductor sized per applicable table in NEC 250.

### 3.6 GENERATOR GROUNDING

- A. Separately derived systems (i.e. systems where generator neutral is not solidly interconnected to service supplied system neutral such as 4-pole switched neutral transfer switch systems).
  1. Ground per NEC 250 and these specifications.
  2. Bond neutral to transformer frame/enclosure and the equipment grounding conductors of the derived system with copper ground conductor sized per applicable table in NEC 250.
  3. Connect generator neutral/ground to grounding electrodes per NEC 250 with grounding electrode conductor sized per applicable table in NEC 250.
  4. In addition to connection to grounding electrode conductor called for above (i.e. per NEC 250) provide, install and connect supplemental grounding electrode as follows:
    - a) Where grounding required per NEC 250 is to building steel/structure, supplement this grounding with connection to nearest available effectively grounded metal water pipe.
    - b) Where grounding connection required per NEC 250 is to grounded metal water pipe, supplement this grounding with connection with connection to other electrodes specified in NEC 250.
    - c) Where supplemental grounding electrodes required above is a ground rod electrode, provide, install and connect two or mote 30' ground rod electrodes at no less than 30' spacing, driven vertical to a minimum depth of 30' plus 1' below grade.
  5. Where neither building steel nor water pipe grounding electrodes are available (i.e. exterior locations with no available water pipe electrode) provide two ground connections: each to two or more 30' ground rod electrodes at no less than 30' spacing, driven vertical to a minimum depth of 30' plus 1' below grade.
  6. Where generator is mounted exterior to building, one of the two ground electrodes required shall be ground rod electrode as called for in paragraph 5. above. This ground rod electrode shall also be connected to counterpoise system.
- B. Non separately derived systems (i.e. systems where generator neutral is solidly interconnected to service supplied system neutral such as 3-pole non-switched neutral transfer switch systems).
  1. Ground per NEC 250 and these specifications.
  2. Do not bond neutral to transformer frame/enclosure or the equipment grounding conductors of the derived system.
  3. Connect generator frame/enclosures ground to grounding electrode per NEC 250 with grounding electrode conductor sized per applicable table in NEC 250.
  4. In addition to connection to grounding electrode conductor called for above (i.e. per NEC 250) provide, install and connect supplemental grounding electrode as follows:

- a) Where grounding required per NEC 250 is to building steel/structure, supplement this grounding with connection to nearest available effectively grounded metal water pipe.
  - b) Where grounding connection required per NEC 250 is to grounded metal water pipe, supplement this grounding with connection to other electrodes specified in NEC 250.
  - c) Where supplemental grounding electrodes required above is a ground rod electrode, provide, install and connect two or more 30' ground rod electrodes at no less than 30' spacing, driven vertical to a minimum depth of 30' plus 1' below grade.
5. Where neither building steel nor water pipe grounding electrodes are available (i.e. exterior locations with no available water pipe electrode) provide two ground connections each to two or more 30' ground rod electrodes at no less than 30' spacing, driven vertical to a minimum depth of 30' plus 1' below grade.
  6. Where generator is mounted exterior to building, one of the two ground electrodes required shall be ground rod electrode as called for in paragraph 5. above. This ground rod electrode shall also be connected to counterpoise system.
- C. Provide additional ground electrodes as required to achieve specified ground resistance.
  - D. Where two or more ground electrodes are used at any one required ground location, they shall be bonded together with a copper ground conductor, sized to meet applicable table in NEC 250, but in no case less than #2/0.
  - E. Complete installation shall exceed the minimum requirements of NEC 250.
  - F. Equipment ground conductors shall be provided in addition to above grounding. See 'Equipment Grounding Conductors.'

### 3.7 LIGHTNING PROTECTION SYSTEMS

- A. Ground per applicable section on lightning protection system, NFPA 780, and as specified herein. The most stringent requirements shall govern.
- B. Bond lightning protection system grounds to electrical service system ground, all piping entering or leaving all buildings, and counterpoise system ground where provided.
- C. See Section 16671 Lightning Protection System.

### 3.8 EXTERIOR GRADE (OR FREE STANDING ABOVE GROUND) MOUNTED EQUIPMENT

- A. General:
  1. All equipment (including chillers, pumps, disconnects, starters, control panels, panels, etc) mounted exterior to building shall have their enclosures grounded directly to a grounding electrode at the equipment location in addition to the building equipment ground connection.
  2. Bond each equipment enclosure, metal rack support, mounting channels, etc. to ground electrode system at each rack with an insulated copper ground conductor sized to match the grounding electrode conductor required by applicable table in NEC 250 based on equipment feeder size, but in no case shall conductor be smaller than #6 copper or larger than #2 copper. This connection is in addition to grounding electrode connections required for services.
- B. Main electrical service rack mounted equipment.
  1. Ground per "Main Electrical Service."
  2. Bond all metal parts as noted above.
- C. Electrical sub service rack mounted equipment.

1. Ground per "Main Electrical Service," except do not bond neutral to ground.
  2. Bond all metal parts as noted above.
- D. Electrical equipment connection rack mounted equipment.
1. Bond all metal parts as noted above.
- E. Grounding electrodes (ground electrodes system) shall be:
1. Located at each rack location.
  2. For service equipment: Ground electrode required per "Main Electrical Service."
  3. For equipment connection equipment: Two or more 30' ground rods at no less than 30' spacing, driven vertical to a minimum depth of 1' below grade. Bond the two or more ground rods together with a size to meet applicable table in NEC 250, but no less than a #2 copper ground conductor. Provide additional rod electrodes as required to achieve specified ground resistance.
- F. Complete installation shall exceed the minimum requirements of NEC 250 and, when applicable, NFPA 780.

### 3.9 ROOF MOUNTED EQUIPMENT

- A. Bond all roof mounted electrical equipment to lightning protection system (when provided) per NFPA 780.
- B. Where lightning protection system is not provided, ground/bond all roof mounted electrical equipment to building steel and to two or more 30' ground rods at no less than 30' spacing driven vertically to a minimum depth of 30' plus 1' below grade.
1. Bond the two or more ground rods together with a Class I or Class II as required per NFPA 780 lightning protection main copper conductor.
  2. Provide additional rod electrodes as required to achieve specified ground resistance.
  3. Complete installation shall exceed the minimum requirements of NFPA 780.

### 3.10 LIGHTING FIXTURES

- A. All fixtures in building interior, and exterior fixtures shall be provided with green grounding conductor, solidly connected to unit. Individual fixture grounds shall be with lug to fixture body, generally located at point of electrical connection to the fixture unit.
- B. All suspended fixtures and those supplied through flexible metallic conduit shall have green ground conductor from outlet box to fixture. Cord connected fixtures shall contain a separate green ground conductor.
- C. Pole Light Fixtures:
1. Metal Pole Light Fixtures:
    - a) Freestanding pole mounted lighting fixtures shall each have a Class I or Class II lightning protection main copper down conductor connected to grounding electrodes at base of pole.
    - b) Conductor shall be bonded to metal pole via UL Listed ground clamp suitable for use. Locate ground lug opposite to handhole (or adjacent if visible through handhole).
  2. Concrete or Non-Metallic Pole:
    - a) Freestanding pole mounted lighting fixtures shall each have a Class I or Class II lightning protection main copper down conductor connected to grounding electrodes at base of pole.

- b) Conductor shall be extended from grounding electrode to top of pole and terminate at the top of pole in a Class I or Class II copper lightning protection air terminal.
- c) Each metal part of light fixture assembly, bracket, ballast cabinet, disconnect, transformer, etc. that is mounted to pole shall be bonded to down conductor.
3. Fixtures located on elevated roadway ramps shall be specially provided with a connection to lightning counterpoise grounding system, properly installed.
4. Grounding electrode(s) at each pole shall be connected (bonded) to site distribution counterpoise system.
5. Grounding Electrodes:
  - a) Two or more 30' ground rods at no less than 30' spacing shall be driven vertically to a minimum depth of 30' plus 1' below grade.
  - b) Bond the two or more ground rod electrodes together with a Class I or Class II lightning protection main copper conductor.
  - c) Provide additional rod electrodes as required to achieve specified ground resistance.
  - d) The two or more grounding rod electrodes shall be installed at each light pole.
6. Installation shall exceed minimum requirements of NFPA 780.

### 3.11 PULLBOX, MANHOLE, HANDHOLE GROUNDING.

- A. One 30 ft. ground rod electrode shall be driven vertically to a minimum depth of 30' plus 1' below grade in each manhole, handhole or pullbox (in ground).
- B. The complete installation shall exceed the minimum requirements of the NEC.
- C. Provide additional ground rod electrodes as required to provide resistance called for herein.
- D. Where more than one ground rod electrode is required bond the two or more ground rod electrodes together with a copper ground conductor.
- E. Bond to counterpoise system (whenever counterpoise system is provided.)
- F. Bond grounding electrode to all exposed metal parts of manhole, handhole, and pullbox (including metal cover) with #6 copper ground conductor. Connect to ground rod electrode with exothermic weld. Connect to metal cover with exothermic weld. Connect to other metal parts with exothermic weld or UL accepted grounding clamp. Provide 3' or more slack ground cable on cover connection as required to facilitate removal of cover.

### 3.12 HAZARDOUS LOCATIONS

- A. Ground in hazardous locations shall be done in accordance with applicable portions of NEC 500, 501, 502, 503, 511 and 514.

### 3.13 MISCELLANEOUS GROUNDING CONNECTIONS

- A. Provide bonding to meet regulatory requirements.
- B. Required connections to building steel shall be with UL accepted non-reversible crimp type ground lugs exothermically welded to bus bar that is either exothermically welded to steel or bolted to steel in locations where weld will affect the structural properties of the steel. Required connections to existing building structural steel purlins/I beams shall be with heavy duty bronze "C" clamp with two bolt vise-grip cable clamp.
- C. Grounding conductors shall: be so installed as to permit shortest and most direct path from equipment to ground; be installed in conduit; be bonded to conduit at both ends when conduit is metal; have connections accessible for inspection; and made with accepted solderless connectors brazed (or bolted) to the equipment or to be grounded; in NO case be a current



carrying conductor; have a green jacket unless it is bare copper; be run in conduit with power and branch circuit conductors. The main grounding electrode conductor shall be exothermically welded to ground rods, water pipe, and building steel.

- D. All surfaces to which grounding connections are made shall be thoroughly cleaned to maximum conductive condition immediately before connections are made thereto. Metal rustproofing shall be removed at grounding contact surfaces, for 0 ohms by digital Vm. Exposed bare metal at the termination point shall be painted.
- E. All ground connections that are buried or in otherwise inaccessible locations, shall be welded exothermically. The weld shall provide a connection which shall not corrode or loosen and which shall be equal or larger in size than the conductors joined together. The connection shall have the same current carrying capacity as the largest conductor.
- F. Install ground bushings on all metal conduits entering enclosures where the continuity of grounding is broken between the conduit and enclosure (i.e. metal conduit stub-up into a motor control center enclosure or at ground bus bar). Provide an appropriately sized bond jumper from the ground bushing to the respective equipment ground bus or ground bus bar.
- G. Install ground bushings on all metal conduits where the continuity of grounding is broken between the conduit and the electrical distribution system (i.e. metal conduit stub-up from wall outlet box to ceiling space. Provide an appropriately sized bond jumper from the ground bushing to the respective equipment ground bus or ground bus bar.
- H. Each feeder metallic conduit shall be bonded at all discontinuities, including at switchboards and all subdistribution and branch circuit panels with conductors in accordance with applicable table in NEC 250 for parallel return with respective interior grounding conductor.
- I. Grounding provisions shall include double locknuts on all heavywall conduits.
- J. Bond all metal parts of pole light fixtures to ground rod at base.

### 3.14 GROUNDING BAR/GROUND BUS (INCLUDING SYSTEMS GROUND BUS/BAR ON GROUND BUS/BAR) INSTALLATION

- A. Where indicated on the Drawings, provide and install grounding bar/ground bus (bus bar). These bus installations are intended to provide a low-impedance "earthing" path for surge voltages, which are electrically "clamped" and shunted to earth by variable-impedance surge protective devices. Metal sheaths of underground cables are also to be grounded thereto at points of building entrance.
- B. Mount bolt tapping lugs with hex head bolts to bus bar at 2" o.c. spacing, one for each ground conductor.
- C. Mount bus bar to wall using 2" polyester molded insulator stand-off.
- D. Extend a #2/0 (minimum size) or larger THWN insulated copper ground conductor (if larger size is called for on drawings or required by NEC for service ground, etc.) in PVC conduit to accepted service ground installation or ground bus/bar in main service equipment enclosure.
- E. Extend #6 insulated copper ground wire from respective bus/bar to each 'local' ground bus/bar in each cabinet for Section 16700-16799 system.
- F. 'SYSTEMS' grounding bus/bar must be connected with #2/0 insulated copper conductor to grounding electrodes system as defined in NEC 800.100(B).

### 3.15 COUNTERPOISE SYSTEM

- A. Install counterpoise and ground over all sections of underground ductbanks, conduits, or cables outside (exterior) to building.

- B. No. 2 bare stranded copper counterpoise shall be run 6" above all underground duct banks, conduits and cables outside (exterior) to building.
- C. Provide one counterpoise conductor for ductbanks (or conduit groupings) 12" wide or less. Provide two counterpoise conductors above outside edge of ductbank (or conduit groupings) over 12" wide.
- D. Counterpoise shall run to building and be grounded at each building to the main building electrical service ground rod electrode (exterior to building). Counterpoise shall be bonded to ground rod at all light poles, pullboxes, manholes, handholes and at each building. Provide and install appropriate ground rod every 150' length of counterpoise conductor (see "Grounding Electrodes"). Counterpoise conductor shall not be run into interior of building. Route counterpoise underground around exterior perimeter of building to main service ground rod installation.

### 3.16 COMMUNICATIONS SYSTEMS

- A. Provide and install all grounding as required by NEC Article 800 and where available on project: Articles 810 (Radio and Television Equipment); 820 (Community Antenna Television and Radio Distribution Systems); and 830 (Network-Powered Broadband Communications Systems).
- B. Provide and install grounding electrode at point of entry of communication cables and bond to service entrance grounding electrodes per NEC 800. Install ground bus bar at point of entry of communications cable and connect electrode to ground bus. Connect communications cable metal sheath and surge protection devices to ground bar.

### 3.17 TESTING AND REPORTS

- A. Raceway Continuity: Metallic raceway system as a component of the facilities ground system shall be tested for electrical continuity. Resistance to ground throughout the system shall not exceed specified limits.
- B. Ground resistance measurements shall be made on each system utilized in the project. The ground resistance measurements shall include building structural steel, driven grounding system, water pipe grounding system and other accepted systems as may be applicable. Ground resistance measurements shall be made in normally dry weather, not less than twenty-four hours after rainfall, and with the ground under test isolated from other grounds and equipment. Resistances measured shall not exceed specified limits.
- C. Upon completion of testing, the testing conditions and results shall be certified by the Contractor and submitted to the Architect/Engineer as called for in Section 16090 Test and Performance Verification.
- D. Ground rod resistance test results shall be submitted to Engineer and Building Department prior to Substantial Completion. A test report certified by the Contractor shall be submitted as a close-out document for the project.

### 3.18 INTERFACE WITH OTHER PRODUCTS

- A. Interface with site grounding system.
- B. Interface with lightning protection system installed under Section 16671 Lightning Protection System.
- C. Interface with communications system installed under 16700 series specification sections.

### 3.19 FIELD QUALITY CONTROL

- A. Inspect grounding and bonding system conductors and connections for tightness and proper installation.
- B. Use suitable test instrument to measure resistance to ground of system. Perform testing in accordance with test instrument manufacturer's recommendations using the fall-of-potential method.

END OF SECTION

SECTION 16180 - EQUIPMENT WIRING SYSTEMS

PART 1 - GENERAL

1.1 DESCRIPTION OF SYSTEM

- A. Provide and install all equipment, labor, material, accessories, and mounting hardware for a complete and operating system for the following:
  - 1. Electrical connections to equipment specified under other sections.

1.2 RELATED SECTIONS

- A. Summary of Work
- B. Conduit.
- C. Building Wire and Cable.
- D. Boxes.

1.3 REFERENCES

- A. NEMA WD 1 - General Purpose Wiring Devices.
- B. NEMA WD 6 - Wiring Device Configurations.
- C. ANSI/NFPA 70 - National Electrical Code.

1.4 SUBMITTALS

- A. Submit under provisions of the General Requirements of the Contract Documents and Section 16012.

1.5 REGULATORY REQUIREMENTS

- A. Conform to requirements of ANSI/NFPA 70.
- B. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and shown.

1.6 COORDINATION

- A. Submit under provisions of the General Requirements of the Contract Documents and Section 16010.
- B. Obtain and review shop drawings, product data, and manufacturer's instructions for equipment furnished under other sections.
- C. Determine connection locations and requirements.
- D. Sequence rough-in of electrical connections to coordinate with installation schedule for equipment.
- E. Sequence electrical connections to coordinate with start-up schedule for equipment.

PART 2 - PRODUCTS

2.1 CORDS AND CAPS

- A. Attachment Plug Construction: Conform to NEMA WD 1.
- B. Configuration: NEMA WD 6; match receptacle configuration at outlet provided for equipment.
- C. Cord Construction: ANSI/NFPA 70, Type SO multiconductor flexible cord with identified equipment grounding conductor, suitable for use in damp locations.
- D. Size: Suitable for connected load of equipment, length of cord, and rating of branch circuit

overcurrent protection.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Verify conditions under provisions of Section 16061.
- B. Verify that equipment is ready for electrical connection, wiring, and energization.

#### 3.2 ELECTRICAL CONNECTIONS

- A. Make electrical connections in accordance with equipment manufacturer's instructions.
- B. Make conduit connections to equipment using flexible conduit. Use liquidtight flexible conduit with watertight connectors in damp or wet locations (including inside of coolers/freezers).
- C. Make wiring connections using wire and cable with insulation suitable for temperatures encountered in heat producing equipment and in cooler/freezers.
- D. Provide receptacle outlet where connection with attachment plug is required. Provide cord and cap where field-supplied attachment plug is required.
- E. Provide suitable strain-relief clamps and fittings for cord connections at outlet boxes and equipment connection boxes.
- F. Install disconnect switches, controllers, control stations, and control devices as required.
- G. Modify equipment control wiring with terminal block jumpers as required.
- H. Provide interconnecting conduit and wiring between devices and equipment where required.
- I. Coolers and Freezers: Cut and seal conduit openings in freezer and cooler walls, floor, and ceilings.

#### 3.3 EQUIPMENT CONNECTION SCHEDULE

- A. By local authority and as required for a complete and operating service.

END OF SECTION

SECTION 16190 - HANGERS AND SUPPORTS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
  - 1. Conduit and equipment supports.
  - 2. Anchors and fasteners.
- B. Furnish and install all supports, hangers and inserts required to mount fixtures, conduit, cables, pullboxes and other equipment furnished under this Division.

1.3 REFERENCES

- A. NECA National Electrical Contractors Association
- B. ANSI/NFPA 70 National Electrical Code

1.4 REGULATORY REQUIREMENTS

- A. Conform to requirements of ANSI/NFPA 70.
- B. Furnish products listed and classified by Underwriters Laboratories as suitable for purpose specified and shown.

PART 2 - PRODUCTS

2.1 PRODUCT REQUIREMENTS

- A. Materials and Finishes: Provide corrosion resistance.
- B. Provide materials, sizes, and types of anchors, fasteners and supports to carry the loads of equipment and conduit. Consider weight of wire in conduit when selecting products.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Provide anchors, fasteners, and supports in accordance with NECA National Electrical Installation Standards.
- C. Do not fasten supports to pipes, ducts, mechanical equipment or conduit.
- D. Do not use spring steel clips and clamps.
- E. Obtain permission from A/E before using powder-actuated anchors.
- F. Obtain permission from A/E before drilling or cutting structural members.
- G. Fabricate supports from structural steel or steel channel. Rigidly weld members or use hexagon head bolts to present neat appearance with adequate strength and rigidity. Use spring lock washers under all nuts.
- H. Install surface-mounted cabinets and panelboards with minimum of four anchors.
- I. In wet and damp locations use steel channel supports to stand cabinets and panelboards 1" off wall.

- J. Use sheet metal channel to bridge studs above and below cabinets and panelboards recessed in hollow partitions.
- K. All items shall be supported from the structural portion of the building, except standard ceiling-mounted lighting fixtures, and small devices may be supported from ceiling system where permitted by Ceiling Contractor, however, no sagging of the ceiling will be permitted. Wire shall not be used as a support. Boxes and conduit shall not be supported or fastened to ceiling suspension wires or to ceiling channels.
- L. This Contractor shall lay out and install his work in advance of the laying of floors or walls, and shall furnish and install all sleeves that may be required for openings through floors, wall, etc. Where plans call for conduit to be run exposed, this Contractor shall furnish and install all inserts and clamps for the supporting of conduit. If this Contractor does not properly install all sleeves and inserts required, he will be required to do the necessary cutting and patching later at his own expense to the satisfaction of the Architect.
- M. All conduits shall be securely fastened in place per NEC. Hangers, supports or fastenings shall be provided at each elbow and at the end of each straight run terminating at a box or cabinet. The use of perforated iron for supporting conduits will not be permitted. The required strength of the supporting equipment and size and type of anchors shall be based on the combined weight of conduit, hanger and cables. Horizontal and vertical conduit runs may be supported by one-hole malleable straps, clamp-backs, or other accepted devices with suitable bolts, expansion shields (where needed) or beam-clamps for mounting to building structure or special brackets.
- N. Where two or more conduits are run parallel or in a similar direction, they shall be grouped together and supported by means of Kindorf type trapeze hanger system (racking) consisting of concrete inserts, threaded solid rods, washers, nuts and galvanized "L" angle iron, or Unistrut cross members. These conduits shall be individually fastened to the cross member of every other trapeze hanger with galvanized cast one hole straps, clamp backs, bolted with proper size cadmium machine bolts, washers and nuts. If adjustable trapeze hangers are used to support groups of parallel conduits, U-bolt type clamps shall be used at the end of a conduit run and at each elbow. J-bolts, or accepted clamps, shall be installed on each third intermediate trapeze hanger to fasten each conduit.
- O. Hanger assemblies shall be protected after fabrication by galvanizing. Hangers for PVC coated conduit shall be PVC coated galvanized conduit or stainless steel.
- P. On concrete or brick construction, insert anchors shall be installed with round head machine screws. In wood construction, round head screws shall be used. An electric or hand drill shall be used for drilling holes for all inserts in brick, concrete or similar construction. In brick, inserts shall be near center of brick, not near edge or in joint. Where steel members occur, same shall be drilled and tapped, and round head machine screws shall be used. All screws, bolts, washers, etc., used for supporting conduit or outlets shall be fabricated from rust-resisting metal, or accepted substitution. Fasteners similar to "TAP-CON" self tapping power driven type are acceptable. Plastic anchors are not acceptable.
- Q. Conduit supporting devices such as spring type conduit clips manufactured by Caddy Corporation may not be used.
- R. Threaded rod hangers shall be galvanized continuous thread type, minimum 3/8" diameter.
- S. Concrete/insert anchors, threaded rods, or similar fasteners installed on side or bottom of prestressed beams are not acceptable.

END OF SECTION

SECTION 16195 - 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 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Provide and install all equipment, labor and material for a complete identification system, including but not limited to:
  - 1. Nameplates and labels.
  - 2. Wire and cable markers.
  - 3. Conduit markers.
- B. Identify all new and existing conduits, boxes, equipment, etc. as specified herein.

1.3 REFERENCES

- A. ANSI/NFPA 70 National Electrical Code.
- B. Americans with Disabilities Act

1.4 REGULATORY REQUIREMENTS

- A. Conform to requirements of ANSI/NFPA 70.
- B. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and shown.

PART 2- PRODUCTS

2.1 NAMEPLATES

- A. Nameplates shall be laminated phenolic plastic, chamfered edges.
  - 1. 120/208 Volt System:
    - a) Black front and back, white core, lettering etched through outer covering, white engraved letters on black background.
  - 2. Emergency System:
    - a) Red with white letters.
  - 3. Emergency Power:
    - a) Red front and back, white core, lettering etched through outer covering, white engraved letters on red background.
- B. Letter Size:
  - 1. 1/8" letters for identifying individual equipment and loads.
  - 2. 1/4" letters for identifying grouped equipment and loads.
- C. Nameplates shall adequately describe the function of the particular equipment involved. Where nameplates are detailed on the Drawings, inscription and size of letters shall be as shown and shop drawing submitted for acceptance. Nameplates for panelboards, switchboards, motor control centers, disconnects and enclosed breakers shall include the panel designation, voltage and phase of the supply. For example, "Panel A, 120/208V, 3-phase, 4-wire." In addition, provide phenolic label in panel to describe where the panel is fed from and location. For

example, "Fed From MDP-1:3:5 Electrical Room #E101 Level 1." Nameplates for equipment listed below shall describe particular equipment name and associated panel/circuit, if applicable. The name of the machine on the nameplates for a particular machine shall be the same as the one used on all motor starters, disconnect and pushbutton station nameplates for that machine.

- D. The following items shall be equipped with nameplates:
1. All motors, motor starters, motor-control centers, pushbutton stations, control panels, time switches, disconnect switches, transformers, panelboards, circuit breakers (i.e., all 2-pole, 3-pole circuit breakers), contactors or relays in separate enclosures, power receptacles where the nominal voltage between any pair of contacts is greater than 150V, wall switches controlling outlets that are not located within sight of the controlling switch, high voltage boxes and cabinets, large electrical, and electrical systems (Systems Sections 16700 through 16799), junction and pull boxes (larger than 4-11/16"), terminal cabinets, terminal boards, and equipment racks. Nameplates shall also describe the associated panel and circuit number, if applicable.
- E. All electrical system panels, transfer switches, motor control centers, disconnect switches, motor controllers, etc. shall be labeled as per branch, i.e., "Panel ABC Emergency-Life Safety Branch" (similar for emergency legally required standby branch, or emergency optional standby branch).

## 2.2 WIRE MARKERS

- A. Description: Cloth, tape, split sleeve or tubing type wire markers.
- B. Locations: Each conductor at panelboard gutters, pull boxes, outlet and junction boxes, and each load connection.
- C. Legend:
1. Power and Lighting Circuits: Branch circuit or feeder number indicated on Drawings including neutral conductor.
  2. Control Circuits: Control wire number indicated on schematic and interconnection diagrams on shop drawings.

## 2.3 CONDUIT/JUNCTION BOX COLOR CODE

- A. All conduit system junction boxes (except those subject to view in public areas) shall be color coded as listed below:

<u>COLOR CODE FOR JUNCTION BOXES</u>	<u>KRYLON PAINT NUMBER</u>
System Emergency 277/480 volt	Cherry Red K02101
System Emergency 120/208 volt	Zinger Pink S01150
Fire Alarm	Popsicle Orange K02410
Normal Power 277/480 volt	Leather Brown K02501
Normal Power 120/208 volt	Glossy Black K01601
Fiber Optics	Plum Purple K01929
Sound System	Daisy Yellow K01813
Clock/Radio	Light Blue S01540
Intercom	True Blue K01910
Computer/Data	Gold K01701
TV	Glossy White K01501
BAS	Cameo White K04129
Telephone	Clover Green K02012
Grounding	Fluorescent Green K03106

- B. Conduit (not subject to public view) longer than 20' shall be painted with above color paint band



20 ft. on center. Paint band shall be 4" in length, applied around entire conduit. Where conduit is parallel and on conduit racking, the paint bands shall be evenly aligned. Paint shall be neatly applied and uniform. Paint boxes and raceways prior to installation, or tape conduits and surrounding surfaces to avoid overspray. Paint overspray shall be removed.

- C. Junction boxes and conduits located in public areas (areas that can be seen by the public) shall be painted to match surface to which it is attached. Provide written request to A/E for interpretation of those public areas which may be in question.

#### 2.4 CONDUIT/JUNCTION BOX MARKER

- A. All new and existing junction boxes/cover plates for power, lighting and systems (except those installed in public areas) shall adequately describe its associated panel and circuit reference number(s) within (i.e. ELRW-2, 4, 6), or systems within (i.e. fire alarm, intercom, etc.). Identification shall be neatly written by means of black permanent marker. Paint one-half of cover plate with appropriate color above, and one-half with associated panel/circuit or system as described above. Junction box cover plates located in public areas shall be identified with small phenolic labels securely attached. Label colors to be determined by A/E. Large pull/junction boxes (8" x 8" or larger) shall be color identified by painting the corners of box cover plate with specified colors at 45 degree angles; phenolic labels as specified herein.
- B. Identify conduit not installed in public areas with corresponding panel/circuit numbers or corresponding system type as described above. Spacing: 20 ft. on center adjacent to color identification bands.

#### 2.5 UNDERGROUND WARNING TAPE

- A. Description: Minimum 6" wide plastic tape, detectable type, with suitable warning legend describing buried lines. Systems conduits shall have orange colored tape. Power/lighting conduits shall have red colored tape.

### PART 3 - EXECUTION

#### 3.1 PREPARATION

- A. Degrease and clean surfaces to receive nameplates and labels.

#### 3.2 APPLICATION

- A. Install nameplate parallel to equipment lines.
- B. Secure nameplate to equipment front using stainless steel pop rivets.
- C. Secure nameplate to inside surface of door on panelboard that is recessed in finished locations.
- D. Nameplates installed inside on dead front cover shall be self-adhesive tape. Do not drill or install screws in dead front.
- E. Identify new conduit, junction boxes, and outlet boxes using field painting.
- F. Identify new underground conduit using underground warning tape. Install a minimum of one tape per trench at 6" below finished grade. For trenches exceeding 24" in width, provide one tape per 24" of trench width spaced evenly over trench width.
- G. Install wire markers at all new connections and terminations, and at existing connections and terminations modified or altered.

END OF SECTION

## SECTION 16410 – POWER SYSTEM STUDY WITH ARC FLASH ANALYSIS

### PART 1 GENERAL

#### 1.01 SCOPE

- A. The contractor shall furnish short-circuit and protective device coordination studies as prepared by the electrical equipment manufacturer or an approved engineering firm.
- B. The contractor shall furnish an Arc Flash Hazard Analysis Study per the requirements set forth in NFPA 70E - Standard for Electrical Safety in the Workplace. The arc flash hazard analysis shall be performed according to the IEEE Std. 1584-2002 equations that are presented in NFPA70E-2009, Annex D.

The scope of the studies shall include all new distribution equipment supplied by the equipment Manufacturer under this contract as well as all directly affected existing distribution equipment associated with the Project.

#### 1.02 DESCRIPTION

- A. Provide all labor, materials, and equipment necessary to properly and completely perform a Power System Study for the electrical distribution and control equipment and submit results in a report.
- B. Electrical distribution and control equipment is to include all equipment installed under this contract and all existing equipment that this project is connecting to, complete from new equipment to existing power company transformer(s) via all applicable existing power distribution and control equipment.
- C. Provide an up to date electrical system single-line diagram as required by NFPA 70E, "Standard for Electrical Safety in the Workplace", as referenced in OSHA 29 CFR 1910 Subpart S, Appendix A. This information shall include nameplate data for electrical components (e.g. transformers, medium voltage switchgear, panelboards, switchboards, motor control centers, etc.) for all portions of the electrical system from the utility intertie through the lowest rated panel.
- D. Cable sizes, types and lengths between electrical equipment components and up to date utility source data shall be provided for an accurate single-line representation of the electrical system. Unique characteristics of the equipment installation shall be provided which may impact the magnitude of the potential hazard (e.g. open space versus enclosure). Overcurrent device settings shall be verified.
- E. Data collection may require removal of barriers, opening of front panels, etc. while equipment is energized. The Contractor must provide proof (written documentation) that its employees working on the premises of the Building have been properly trained in the use and application of personal protective equipment (PPE) and the hazards of working on or near energized equipment. The Contractor must provide its own PPE protection with a minimum arc thermal performance rating (ATPV) of 40 calories/cm<sup>2</sup>.
- F. The contractor shall be responsible for obtaining all required data of all equipment.

- G. The study shall verify adequacy of all equipment implemented under these specifications and to verify the correct application of circuit protective devices and other system components specified completely coordinated with the existing system.
- H. A comprehensive analysis of the Building electrical system noted above shall be performed for all equipment 480 volt and higher and 240 volt served by a 125kVA or larger transformer based on the up to date single-line diagram provided from "Section A". This analysis shall include the following:
  - 1. Short Circuit Study – A short circuit analysis shall be performed in accordance with ANSI standard C37 and IEEE standard 141-1993 (Red Book) for each electrical component as defined in "Section A. "
  - 2. Coordination Study – A coordination study shall be performed in accordance with IEEE 242-2001 "Buff" to determine the proper overcurrent device settings that will balance system reliability through selective coordination while minimizing the magnitude of an electrical arc flash hazard incident.
  - 3. Incident Energy Study – An incident energy study shall be done in accordance with the IEEE 1584-2004a, "IEEE Guide for Performing Arc Flash Hazard Calculations" as referenced in NFPA 70, "Standard for Electrical Safety in the Workplace", latest revision, in order to quantify the hazard for selection of personal protective equipment (PPE). Tables that assume fault current levels and clearing time for proper PPE selection are not acceptable.
- I. Reconcile arc flash protective device setting recommendations with the protective device time-current coordination study.
- J. Adjust the System Design to optimize the results of the study as it relates to safety and reliable electrical system operation (e.g. overcurrent device settings, working distances, current limiting devices). This includes mitigation, where possible, of incident energy levels that exceed 40 calories/cm<sup>2</sup>. A qualified engineer with power systems design experience shall provide this assistance
- K. The intent /goal of the protective system included herein is to establish arc flash levels that result in PPE levels of Category 2 or less.
- L. Identify locations where Category 2 cannot be achieved.
- M. The study shall address the case when the system is being powered from the normal source as well as from the on-site generating source.
- N. Minimum as well as maximum possible fault conditions shall be covered in the study.
- O. Fault conditions of all motors shall be considered.

### 1.03 REFERENCES

- A. Institute of Electrical and Electronics Engineers, Inc. (IEEE):
  - 1. IEEE 141 – Recommended Practice for Electric Power Distribution and Coordination of Industrial and Commercial Power Systems
  - 2. IEEE 242 – Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems
  - 3. IEEE 399 – Recommended Practice for Industrial and Commercial Power System Analysis

4. IEEE 241 – Recommended Practice for Electric Power Systems in Commercial Buildings
  5. IEEE 1015 – Recommended Practice for Applying Low-Voltage Circuit Breakers Used in Industrial and Commercial Power Systems.
  6. IEEE 1584 - Guide for Performing Arc-Flash Hazard Calculations
- B. American National Standards Institute (ANSI):
1. ANSI C57.12.00 – Standard General Requirements for Liquid-Immersed Distribution, Power, and Regulating Transformers
  2. ANSI C37.13 – Standard for Low Voltage AC Power Circuit Breakers Used in Enclosures
  3. ANSI C37.010 – Standard Application Guide for AC High Voltage Circuit Breakers Rated on a Symmetrical Current Basis
  4. ANSI C 37.41 – Standard Design Tests for High Voltage Fuses, Distribution Enclosed Single-Pole Air Switches, Fuse Disconnecting Switches and Accessories.
- C. The National Fire Protection Association (NFPA)
1. NFPA 70 - National Electrical Code, latest edition
  2. NFPA 70E – Standard for Electrical Safety in the Workplace
- 1.04 SUBMITTALS FOR REVIEW/APPROVAL
- A. The short-circuit and protective device coordination results shall be submitted prior to receiving final approval of the distribution equipment shop drawings and ~~or~~ prior to release of equipment drawings for manufacturing. This preliminary submittal of study data shall be sufficient to ensure that the selection of device and characteristics will be satisfactory.
- 1.05 SUBMITTALS FOR CONSTRUCTION
- A. The results of the short-circuit, protective device coordination and arc flash hazard analysis studies shall be summarized in a final report.. For large system studies, submittals requiring more than five (5) copies of the report will be provided without the section containing the computer printout of the short-circuit input and output data. Additional copies of the short-circuit input and output data, where required, shall be provided on CD in PDF format.
- B. For large system studies with more than 200 bus locations, the contractor is required to provide the study project files to the Owner in electronic format. In addition, a copy of the computer analysis software viewer program is required to accompany the electronic project files, to allow the Owner to review all aspects of the project and print arc flash labels, oneline diagrams, etc.
- C. The report shall include the following sections:
1. Executive Summary.
  2. Descriptions, purpose, basis and scope of the study
  3. Tabulations of circuit breaker, fuse and other protective device ratings versus calculated short circuit duties

4. Protective device time versus current coordination curves, tabulations of relay and circuit breaker trip unit settings, fuse selection
  5. Fault current calculations including a definition of terms and guide for interpretation of the computer printout
  6. Details of the incident energy and flash protection boundary calculations
  7. Recommendations for system improvements, where needed
  8. One-line diagram
- D. Arc flash labels shall be provided in hard copy only. For large system studies (more than 200 bus locations) arc flash labels shall be provided in hard copy and label images shall be provided in electronic format.
- E. Report shall include:
1. Available fault current at each equipment location with comparison to equipment rating
  2. Overcurrent device settings (e.g. pick-up, time delay, curve), "as found" and "as recommended"
  3. Incident energy level (calories/cm<sup>2</sup>) for each equipment location and recommended PPE
  4. Overcurrent device coordination curves including related section of the single-line diagram
  5. List of prohibited energized work locations based on arc flash results.

#### 1.06 QUALIFICATIONS

- A. The short-circuit, protective device coordination and arc flash hazard analysis studies shall be conducted under the supervision and approval of a Registered Professional Electrical Engineer skilled in performing and interpreting the power system studies.
- B. The Registered Professional Electrical Engineer shall be a full-time employee of the equipment manufacturer or an approved engineering firm.
- C. The Registered Professional Electrical Engineer shall have a minimum of five (5) years of experience in performing power system studies.
- D. The equipment manufacturer or approved engineering firm shall demonstrate experience with Arc Flash Hazard Analysis by submitting names of at least ten actual arc flash hazard analysis it has performed in the past year.

#### 1.07 COMPUTER ANALYSIS SOFTWARE

- A. The studies shall be performed using the latest revision of the SKM Systems Analysis Power\*Tools for Windows (PTW) software program or prior approved equal.

## PART 2 PRODUCT

### 2.01 STUDIES

- A. Contractor to furnish short-circuit and protective device coordination studies as prepared by equipment manufacturer or an approved engineering firm.
- B. The contractor shall furnish an Arc Flash Hazard Analysis Study per NFPA 70E - Standard for Electrical Safety in the Workplace, reference Article 130.3 and Annex D.

### 2.02 DATA COLLECTION

- A. Contractor shall furnish all data as required by the power system studies. The Engineer performing the short-circuit, protective device coordination and arc flash hazard analysis studies shall furnish the Contractor with a listing of required data after award of the contract. The Contractor shall expedite collection of the data to assure completion of the studies as required for final approval of the distribution equipment shop drawings and/or prior to the release of the equipment for manufacturing.
- B. Source combination ~~may~~ shall include present and future motors and generators.
- C. Load data utilized may include existing and proposed loads obtained from Contract Documents provided by Owner, or Contractor when available.
- D. Include fault contribution of existing motors in the study. The Contractor shall obtain required existing equipment data, if necessary, to satisfy the study requirements.

### 2.03 SHORT-CIRCUIT AND PROTECTIVE DEVICE EVALUATION STUDY

- A. Use actual conductor impedances if known. If unknown, use typical conductor impedances based on IEEE Standard 141-1993.
- B. Minimum transformer design impedances shall be used when test impedances are not available.
- C. Provide the following:
  - 1. Calculation methods and assumptions
  - 2. Selected base per unit quantities
  - 3. One-line diagram of the system being evaluated
  - 4. Source impedance data, including electric utility system and motor fault contribution characteristics
  - 5. Tabulations of calculated quantities
  - 6. Results, conclusions, and recommendations.
- D. Calculate short-circuit momentary and interrupting duties for a three-phase bolted fault at each:
  - 1. Electric utility's supply termination point
  - 2. Incoming switchgear
  - 3. Unit substation primary and secondary terminals

4. Low voltage switchgear
  5. Motor control centers
  6. Standby generators and automatic transfer switches
  7. Branch circuit panelboards
  8. Other significant locations throughout the system.
- E. For grounded systems, provide a bolted line-to-ground fault current study for areas as defined for the three-phase bolted fault short-circuit study.
- F. Protective Device Evaluation:
1. Evaluate equipment and protective devices and compare to short circuit ratings
  2. Adequacy of switchgear, motor control centers, and panelboard bus bars to withstand short-circuit stresses
  3. Notify Owner in writing, of existing, circuit protective devices improperly rated for the calculated available fault current.

#### 2.04 PROTECTIVE DEVICE COORDINATION STUDY

- A. Proposed protective device coordination time-current curves (TCC) shall be displayed on log-log scale graphs.
- B. Include on each TCC graph, a complete title and one-line diagram with legend identifying the specific portion of the system covered.
- C. Terminate device characteristic curves at a point reflecting maximum symmetrical or asymmetrical fault current to which the device is exposed.
- D. Identify the device associated with each curve by manufacturer type, function, and, if applicable, tap, time delay, and instantaneous settings recommended.
- E. Plot the following characteristics on the TCC graphs, where applicable:
1. Electric utility's overcurrent protective device
  2. Medium voltage equipment overcurrent relays
  3. Medium and low voltage fuses including manufacturer's minimum melt, total clearing, tolerance, and damage bands
  4. Low voltage equipment circuit breaker trip devices, including manufacturer's tolerance bands
  5. Transformer full-load current, magnetizing inrush current, and ANSI through-fault protection curves
  6. Conductor damage curves
  7. Ground fault protective devices, as applicable
  8. Pertinent motor starting characteristics and motor damage points, where applicable
  9. Pertinent generator short-circuit decrement curve and generator damage point
  10. The largest feeder circuit breaker in each motor control center and applicable panelboard.

- F. Provide adequate time margins between device characteristics such that selective operation is provided, while providing proper protection.

#### 2.05 ARC FLASH HAZARD ANALYSIS

- A. The arc flash hazard analysis shall be performed according to the IEEE Std. 1584-2002 equations that are presented in NFPA70E-2009, Annex D.
- B. The flash protection boundary and the incident energy shall be calculated at all significant locations in the electrical distribution system (switchboards, switchgear, motor-control centers, panelboards, busway and splitters) where work could be performed on energized parts.
- C. The Arc-Flash Hazard Analysis shall include all significant locations in 240 volt and 208 volt systems fed from transformers equal to or greater than 125 kVA where work could be performed on energized parts.
- D. Safe working distances shall be based upon the calculated arc flash boundary considering an incident energy of  $1.2 \text{ cal/cm}^2$ .
- E. When appropriate, the short circuit calculations and the clearing times of the phase overcurrent devices will be retrieved from the short-circuit and coordination study model. Ground overcurrent relays should not be taken into consideration when determining the clearing time when performing incident energy calculations
- F. The short-circuit calculations and the corresponding incident energy calculations for multiple system scenarios must be compared and the greatest incident energy must be uniquely reported for each equipment location. Calculations must be performed to represent the maximum and minimum contributions of fault current magnitude for all normal and emergency operating conditions. The minimum calculation will assume that the utility contribution is at a minimum and will assume a minimum motor contribution (all motors off). Conversely, the maximum calculation will assume a maximum contribution from the utility and will assume the maximum amount of motors to be operating. Calculations shall take into consideration the parallel operation of synchronous generators with the electric utility, where applicable.
- G. The incident energy calculations must consider the accumulation of energy over time when performing arc flash calculations on buses with multiple sources. Iterative calculations must take into account the changing current contributions, as the sources are interrupted or decremented with time. Fault contribution from motors and generators should be decremented as follows:
  - 1. Fault contribution from induction motors should not be considered beyond 3-5 cycles.
  - 2. Fault contribution from synchronous motors and generators should be decayed to match the actual decrement of each as closely as possible (e.g. contributions from permanent magnet generators will typically decay from 10 per unit to 3 per unit after 10 cycles).
- H. For each equipment location with a separately enclosed main device (where there is adequate separation between the line side terminals of the main protective device and the work location), calculations for incident energy and flash protection boundary shall include both the line and load side of the main breaker.



- I. When performing incident energy calculations on the line side of a main breaker (as required per above), the line side and load side contributions must be included in the fault calculation.
- J. Mis-coordination should be checked amongst all devices within the branch containing the immediate protective device upstream of the calculation location and the calculation should utilize the fastest device to compute the incident energy for the corresponding location.
- K. Arc Flash calculations shall be based on actual overcurrent protective device clearing time. Maximum clearing time will be capped at 2 seconds based on IEEE Std. 1584-2002 section B.1.2. Where it is not physically possible to move outside of the flash protection boundary in less than 2 seconds during an arc flash event, a maximum clearing time based on the specific location shall be utilized.

## 2.06 REPORT SECTIONS

- A. Input data shall include, but not be limited to the following:
  - 1. Feeder input data including feeder type (cable or bus), size, length, number per phase, conduit type (magnetic or non-magnetic) and conductor material (copper or aluminum).
  - 2. Transformer input data, including winding connections, secondary neutral-ground connection, primary and secondary voltage ratings, kVA rating, impedance, % taps and phase shift.
  - 3. Reactor data, including voltage rating, and impedance.
  - 4. Generation contribution data, (synchronous generators and Utility), including short-circuit reactance ( $X''d$ ), rated MVA, rated voltage, three-phase and single line-ground contribution (for Utility sources) and X/R ratio.
  - 5. Motor contribution data (induction motors and synchronous motors), including short-circuit reactance, rated horsepower or kVA, rated voltage, and X/R ratio.
- B. Short-Circuit Output Data shall include, but not be limited to the following reports:
  - 1. Low Voltage Fault Report shall include a section for three-phase and unbalanced fault calculations and shall show the following information for each applicable location:
    - a. Voltage
    - b. Calculated fault current magnitude and angle
    - c. Fault point X/R ratio
    - d. Equivalent impedance
  - 2. Momentary Duty Report shall include a section for three-phase and unbalanced fault calculations and shall show the following information for each applicable location:
    - a. Voltage
    - b. Calculated symmetrical fault current magnitude and angle
    - c. Fault point X/R ratio

- d. Calculated asymmetrical fault currents
    1. Based on fault point X/R ratio
    2. Based on calculated symmetrical value multiplied by 1.6
    3. Based on calculated symmetrical value multiplied by 2.7
  - e. Equivalent impedance
  3. Interrupting Duty Report shall include a section for three-phase and unbalanced fault calculations and shall show the following information for each applicable location:
    - a. Voltage
    - b. Calculated symmetrical fault current magnitude and angle
    - c. Fault point X/R ratio
    - d. No AC Decrement (NACD) Ratio
    - e. Equivalent impedance
    - f. Multiplying factors for 2, 3, 5 and 8 cycle circuit breakers rated on a symmetrical basis
    - g. Multiplying factors for 2, 3, 5 and 8 cycle circuit breakers rated on a total basis
- C. Recommended Protective Device Settings:
1. Phase and Ground Relays:
    - a. Current transformer ratio
    - b. Current setting
    - c. Time setting
    - d. Instantaneous setting
    - e. Recommendations on improved relaying systems, if applicable.
  2. Circuit Breakers:
    - a. Adjustable pickups and time delays (long time, short time, ground)
    - b. Adjustable time-current characteristic
    - c. Adjustable instantaneous pickup
    - d. Recommendations on improved trip systems, if applicable.
- D. Incident energy and flash protection boundary calculations
1. Arcing fault magnitude
  2. Protective device clearing time
  3. Duration of arc
  4. Arc flash boundary
  5. Working distance

6. Incident energy
7. Hazard Risk Category
8. Recommendations for arc flash energy reduction

### PART 3 EXECUTION

#### 3.01 FIELD ADJUSTMENT

- A. Adjust relay and protective device settings according to the recommended settings table provided by the coordination study. Field adjustments to be completed by the contractor and/or electrical equipment manufacturer's field service personnel.
- B. Make minor modifications to equipment as required to accomplish conformance with short circuit and protective device coordination studies.
- C. Notify Owner in writing of any required major equipment modifications.

#### 3.02 ARC FLASH WARNING LABELS

- A. The contractor of the Arc Flash Hazard Analysis shall provide a 3.5 in. x 5 in. thermal transfer type label of high adhesion polyester for each work location analyzed.
- B. All labels will be based on recommended overcurrent device settings and will be provided after the results of the analysis have been presented to the owner and after any system changes, upgrades or modifications have been incorporated in the system.
- C. The label shall include the following information, at a minimum:
  1. Location designation
  2. Nominal voltage
  3. Flash protection boundary
  4. Hazard risk category
  5. Incident energy or energy range corresponding to reported Hazard risk category.
  6. Working distance
  7. Engineering report number, revision number and issue date.
- D. Labels shall be machine printed, with no field markings.
- E. Arc flash labels shall be provided in the following manner and all labels shall be based on recommended overcurrent device settings.
  1. For each 600, 480 and applicable 208 volt panelboard, at least one arc flash label shall be provided.
  2. For each motor control center, one arc flash label shall be provided.
  3. For each switchboard, one arc flash label shall be provided.
  4. For each main switchboard with Utility Service, one flash label shall be provided for each section.
- F. Labels shall be field installed by the contractor.

3.03 ARC FLASH TRAINING

- A. The contractor of the Arc Flash Hazard Analysis shall train the owner's qualified electrical personnel of the potential arc flash hazards associated with working on energized equipment (minimum of 4 hours).

SECTION 16421 - UTILITY SERVICE ENTRANCE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Arrangement with utility company for permanent electric service, including payment of utility company charges for service.
- B. Underground service entrance.
- C. Metering equipment.
- D. Temporary Service.
- E. Furnish, install, or otherwise provide all equipment and/or coordination and supervision necessary to furnish a new electrical service to the facility. This shall include all necessary temporary services and connections.
- F. Assessments by the utility company for "Underground vs Overhead" service shall be paid by the Contractor who shall contact the utility company prior to bid for inclusion of this one-time charge.
- G. Assessments by the utility company for permanent electrical service shall be paid by the Owner.
- H. Assessments for temporary electrical service shall be paid by the Contractor who shall contact the utility company prior to bid for inclusion of these charges.

1.3 REFERENCES AND REGULATORY REQUIREMENTS

- A. Conform to the requirements of the following:
  - 1. ANSI/NFPA 70 - National Electrical Code.
- B. Furnish products listed and classified by Underwriters Laboratories as suitable for purpose specified and shown.
- C. The rules and regulations of the local utility company shall govern all service and metering requirements.

1.4 COORDINATION

- A. Fully coordinate with the local utility company to provide electrical service to the facility. Provide underground raceways, trenching, backfilling, etc. where required.

1.5 SUBMITTALS

- A. Submit under provisions of Section 16012 Submittals.
- B. Submit utility company prepared drawings.
- C. Submit product data on:
  - 1. Surge protective devices.
  - 2. Lightning arresters.
  - 3. Meter/C.T. cabinet if applicable.

1.6 QUALITY ASSURANCE

- A. Perform work in accordance with utility company written requirements.

1.7 FIELD MEASUREMENTS

- A. Verify that field measurements are as indicated.

## PART 2 - PRODUCTS

### 2.1 GENERAL

- A. Refer to appropriate sections contained within these Specifications for standards concerning materials used.

### 2.2 UTILITY METERS

- A. Meters will be furnished by utility company.
- B. Description: As indicated on drawings and per Utility company standards.
- C. Poly phase watt hour meter shall be Sangamo Type S40DS or equal, Class 20, transformer rated, to be used on 3-phase, 4 wire, "Y" circuits, 277 volt potential coils, 3 element for use with instrument transformers, meter shall have Type DE-5, 30 minute demand register.
- D. Meter shall be installed in a 13-terminal meter socket, and have a superior #1020F test switch (or accepted substitution) for testing purposes.

### 2.3 UTILITY METER BASE

- A. Provide meter base that complies with utility company's requirements.

### 2.4 TRANSFORMER PAD

- A. Description: Precast concrete transformer pad with cable pit sized as required by power company.

### 2.5 LIGHTNING ARRESTER

- A. Unit shall be Tranquell type as manufactured by General Electric.

### 2.6 SURGE SUPPRESSION

- A. Surge protective devices shall be in accordance with Section 16691 Surge Protective Devices.
- B. Surge protective devices shall meet the following criteria:
  1. Lead configuration: Lines 18" black, neutral 18" white, ground 18" green. Leads shall be #10 AWG copper and shall not be extended to more than 18" factory installed length.
  2. Protective devices shall be connected to load side of circuit breaker in order to remove them from the circuit on failure and an indicator light should verify component failure. Provide circuit breaker sized as recommended by manufacturer in main panel and connect surge protective device.
  3. Surge protective device shall be Atlantic Scientific "Zonemaster 75 Series", unless otherwise specified in other sections of these Specifications, etc as applicable to project.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Verify that service equipment is ready to be connected and energized.

### 3.2 PREPARATION

- A. Make arrangements with utility company to obtain permanent electric service to the project.
- B. Coordinate location of utility company's facilities to ensure proper access is available.
- C. This Contractor shall notify the utility company in writing, with 2 copies to the Engineer, no later than 10 days after signing contracts as to when this Contractor anticipates the building power service will be required.

- D. Contact power company within 15 days of award of contract. Provide power company copies of contract documents needed and/or required by power company within 30 days of contract Notice to Proceed.

### 3.3 TEMPORARY SERVICES

- A. Throughout the period of construction provide all temporary services and connections necessary to maintain without interruption all electrical services in support of construction and Owner activities. The only exception to this requirement shall be scheduled interruptions made with the prior acceptance of the Owner.
- B. The facilities and equipment required to provide all electrical power for construction, lighting and balancing and testing consumed prior to final acceptance of the project shall be provided under this Section of the Specifications. All wiring, outlets and other work required to provide this power at the site and within the building for all trades shall be arranged for, furnished and installed under this section of the specifications including any fee, charge or cost due the utility company for temporary power installation or hook-ups.
- C. Facilities shall be furnished in a neat and safe manner in compliance with governing codes, good working practices and OSHA regulations.

### 3.4 CONTRACTOR RESPONSIBILITIES

- A. The Contractor shall furnish all labor, materials, etc., necessary for a complete accepted electrical service as required for this project, including inspection and acceptance by the utility and local inspection departments (if any) and inform the Engineer prior to energizing power lines within the structure.

### 3.5 UNDERGROUND ELECTRICAL SERVICE

- A. Furnish and install underground 208/120 volt, 3 phase, 4 wire service from power company pad mounted transformer to main service equipment. Seal conduit with duc-seal where entering building.
- B. The underground service shall comply with all the requirements of the NEC, local utility company and state enforcing authority.
- C. The concrete pad shall be furnished and installed by this Contractor and shall comply with the utility company's requirements.
- D. Furnish and install buried primary conduits (minimum of 4" if not sized on the Drawings) from the pad to point of utility company service as shown on Drawings or as required by utility company.
- E. Install service entrance conduits from property line dictated by utility company to pad-mounted transformer to building service entrance equipment.

### 3.6 METERING

- A. Meters and metering equipment shall be furnished and installed under this Division of the Specifications.

### 3.7 LIGHTNING ARRESTERS AND SURGE PROTECTIVE DEVICES

- A. Both lightning arrestor and surge protective device shall be provided on the line side of each main service from transformer. Units shall match service voltage.
- B. Installation including mounting connections, grounding and length of leads shall conform to manufacturer's recommendations.
- C. Surge protective device shall be installed in accordance with Section 16691 Surge Protective Devices.

### 3.8 PAD

- A. Install concrete pad as directed/required by utility company.
- B. Cast-in place pads are to comply with all applicable divisions and sections of these Specifications.

END OF SECTION



SECTION 16441 - ENCLOSED DISCONNECT SWITCHES

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Provide all labor, materials, and equipment necessary to properly install switches as shown on the Drawings and as required by codes.
- B. Coordinate with Division 15 Contractor and Specifications as to who is to provide disconnect switches for mechanical equipment. Provide all disconnect switches not being provided by Division 15 Contractor.

1.3 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Deliver switches in factory wrapped packaging to the site. Handle switches carefully to prevent damage. Store in a clean, dry space protected from dirt, water, and physical damage. Do not install damaged switches.

1.4 QUALITY ASSURANCE

- A. The manufacturer of switches shall be the same as that of the panelboards.

1.5 SUBMITTALS

- A. Submit catalog cut sheet on each type of disconnect switch to be used on this project. Submit catalog cut sheet on enclosure locks to be used on this project.

PART 2 - PRODUCTS

2.1 CONSTRUCTION

- A. Switches shall be heavy duty types with visible, quick-make, quick-break blades.
- B. Units for 2-speed motors shall be 6-pole in a single enclosure. Use of two 3-pole units will not be acceptable.
- C. Provide ground bus, and where required a solid neutral bus.
- D. Switches shall be fusible or nonfusible as denoted on the Drawings or as required by the equipment served from the switch. Fusible switches shall have rejection type fuse holders.
- E. Terminal lugs shall be rated for 75 degrees Centigrade.
- F. Enclosures, unless otherwise noted, shall be NEMA 1 for indoor locations. Krydon or fiberglass material may be used in a NEMA 4X application. All switches mounted outdoors including those noted to be NEMA 3R on drawings shall be heavy duty type 4X, watertight, corrosion resistant.
- G. The enclosure shall be interlocked with the switch handle such that the enclosure door or cover cannot be opened with the switch in the "ON" position. The switch handle shall be capable of being padlocked in the "OFF" position but not in the "ON" position.
- H. Finish for NEMA I units shall be standard baked gray enamel finish over a rust inhibiting phosphate primer.
- I. Each disconnect switch shall be provided with a Homac #ELB-2 or similar enclosure lock. Homac #ELB-2 is available from Graybar Electric.
- J. Disconnect switches installed between any variable speed drive type of unit (VFD, AFD, USD, etc.) and its respective motor(s), shall have auxiliary break before break (open) interlock control

contact.

- K. Disconnect switches installed to disconnect HVAC equipment are to be fusible type with fuses as recommended by HVAC manufacturer.

## 2.2 RATING

- A. The size, number of poles, and fusing for each switch shall be as denoted on the Drawings. As a minimum, no less than one pole for each ungrounded conductor shall be provided. Switches shall be rated 250 VAC or 600 VAC as required by the circuit to which it is connected.
- B. Switches serving motors with more than one set of windings shall have the number of poles necessary to disconnect all conductors to all windings in a single switch. Switches serving motor loads shall be horsepower rated of sufficient size to handle the load.

## 2.3 SERVICE ENTRANCE EQUIPMENT

- A. Switches used as service entrance equipment shall be listed and labeled by UL for use as service equipment.

## 2.4 ENCLOSED CIRCUIT BREAKERS

- A. Molded Case Circuit Breakers: NEMA AB1, plug-on type for 250V or less, bolt-on type for over 250V, thermal magnetic trip circuit breakers, with common trip handle for all poles. Provide circuit breakers UL listed as Type SWD for lighting circuits. Breakers shall be HID rated. Provide UL Class A ground fault interrupter circuit breakers where scheduled. Do not use tandem circuit breakers.
- B. Thermal-magnetic, molded case, with inverse time-current overload and instantaneous magnetic tripping, unless otherwise shown. Breakers shall be calibrated for 40 degrees C or shall be ambient compensating.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Install all switches in accordance with the manufacturer's written instructions, NECA National Electrical Installation Standards, the applicable requirements of the NEC, and recognized industry practice.
- B. All switches shall be firmly anchored to walls and supporting structures (where used) using appropriate installation. Switches shall be installed with the turning axis of their handles approximately 5'-0" above finished floor unless otherwise indicated. Provide rigid steel (galvanized for exterior use) mounting stands, brackets, plates, hardware, and accessories for a complete installation.
- C. Switches shall be mounted in accessible locations chosen where the passageway to the switch is not likely to become obstructed. Where a switch serves as the disconnecting means for a load, the switch shall be located as close as practical to the load with the switch handle within sight of the load.
- D. Provide and install lugs on disconnect switch as required to accept conductors called for on Drawings.
- E. Disconnect switches shall not be mounted on equipment, unless specifically noted or required and meet all applicable codes, etc. If switches are noted or required to be mounted on equipment they shall have vibrator clips on fuses and be connected to conduit system with liquid tight flexible conduit.
- F. Provide and install enclosure lock on each disconnect switch. Enclosure lock bolt shall be tightened firmly but not tight enough to break bolt.
- G. Coordinate all requirements for controls between variable speed drive units and its respective

SECTION 16471 - PANELBOARDS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Provide all labor, materials and equipment necessary to properly and completely install panelboards as scheduled on the drawings and as required by this section.

1.3 REFERENCES

- A. NECA National Electrical Installation Standards
- B. NEMA PB 1 Panelboards
- C. NEMA PB 1.1 General Instructions for Proper Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less
- D. NFPA 70 National Electrical Code
- E. UL 50 Enclosures for Electrical Equipment
- F. UL 67 Panelboards
- G. UL 489 Molded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures

1.4 REGULATORY REQUIREMENTS

- A. Conform to requirements of NFPA 70.
- B. Furnish products listed and classified by UL as suitable for purpose specified and indicated.

1.5 QUALITY ASSURANCE

- A. Perform work in accordance with NECA National Electrical Installation Standards.
- B. Manufacturer: Company specializing in manufacturing the products specified in this section with minimum ten years experience.

1.6 SUBMITTALS

- A. Product data shall be submitted on:
  - 1. Panel
  - 2. Cabinet
  - 3. Bus
  - 4. Dimensions
  - 5. Construction
- B. Shop drawings shall be submitted for every panel on this project. Clearly indicate the following information:
  - 1. UL Label.
  - 2. Each circuit breaker amperage rating, circuit number and position/location in panel.
  - 3. Electrical characteristics of panel.
  - 4. Mains rating.
  - 5. Main device rating.
  - 6. Mounting.
  - 7. Dimension, width, depth, height.
  - 8. Bus material.
  - 9. Interrupting capacity of minimum rated breaker.
  - 10. Panel type.

11. Series AIC rating with upstream breakers.

1.7 PROJECT RECORD DOCUMENTS

- A. Submit record documents to record actual locations of products; indicate actual branch circuit arrangement.

1.8 OPERATION AND MAINTENANCE DATA

- A. Submit Maintenance Data: Include spare parts data listing, source and current prices of replacement parts and supplies, and recommended maintenance procedures and intervals.

1.9 FIELD MEASUREMENTS

- A. Verify that field measurements are as instructed by manufacturer.

1.10 MAINTENANCE MATERIALS

- A. Provide two of each panelboard key.

1.11 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Handle panelboards and enclosures carefully to prevent damage.
- B. Store equipment indoors and protect from weather.
- C. Deliver tubs and internal assemblies sufficiently in advance of installation period as necessary to prevent delay of work. This time shall be established by a CPM provided by the Contractor and accepted by the supervising authorities.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis of Design: Square D.
- B. Approved Substitutions: General Electric or Siemens.
- C. Manufacturers (including accepted substitutions) must provide equipment equal to or superior than the basis of design used on this project.
  - 1. Panels or circuit breakers with an AIC rating less than that shown on the Drawings will not be approved.
  - 2. Where basis of design panelboard can accept a certain type, frame, and/or AIC rated breaker, the accepted substitution manufacturer must also be able to accept all equal breaker type, frame, and/or AIC rating.

2.2 GENERAL

- A. Lighting and Appliance Branch Circuit Panelboards: NEMA PB 1, circuit breaker type, dead front UL 67.
- B. Panelboard Bus: Copper ratings as indicated. Provide copper ground bus in each panelboard. Provide isolated full size neutral bus where neutral is applicable. Provide non-linear load panelboards as specified on drawings. Non-linear panelboards shall have 200 percent rated neutral busbar.
- C. Short Circuit Rating:
  - 1. Minimum Integrated Short Circuit Rating: 10,000 amperes rms symmetrical for 240 volt panelboards; 14,000 amperes rms symmetrical for 480 volt panelboards. Bus shall be braced for minimum capacity equal to or greater than the lowest breaker symmetrical interrupting capacity. Minimum short circuit rating shall be increased to meet the following requirements:

- a) Individual CB AIC rating shown on panel schedules indicate lowest AIC rating allowed for individual circuit breaker in panel.
  - b) Panel Series AIC rating shown is the required rating of panel and its circuit breakers based on series rating of individual panel circuit breakers with panel main circuit breaker or upstream feeder breaker.
  - c) Circuit breaker types are not shown or called for. The Contractor must provide breakers in panel or feeder breakers in upstream breakers to comply with the required AIC ratings given, including providing current limiting breakers where required to achieve all ratings given.
2. Short Circuit Rating Label:
- a) Panelboards shall be labeled with a UL short-circuit rating.
- D. Enclosure:
1. Enclosures shall be at least 20" wide made from galvanized steel. Provide minimum gutter space in accordance with the National Electrical Code. Where feeder cables supplying the mains of a panel are carried through its box to supply other electrical equipment, the box shall be sized to include the additional required wiring space. At least four interior mounting studs with adjustable nuts shall be provided.
  2. Enclosures shall be provided with blank ends.
  3. Where indicated on the drawings, branch circuit panelboards shall be column width type.
  4. Regulatory requirements:
    - a) NEMA PB 1, Type 1, Type 3R, or Type 4X as indicated on Drawings. Use only Type 3R or Type 4X for units to be installed outdoors. Use only Type 4X in interior wet locations and designated wash-down areas. For the purposes of this specification, a wash-down area is defined as any area that is directly washed or rinsed with any form of water hose.
  5. Cabinet Box: 6" deep, 20" wide minimum, constructed of code gauge steel, galvanized or bonderized to prevent rust.
- E. Cabinet Front: Flush or surface (as indicated on Drawings) cabinet front with concealed trim clamps, concealed hinge, and flush lock all keyed alike. Finish in manufacturer's standard baked enamel finish for interior panels. Exterior panels to be painted with rust inhibit primer painted over on all surfaces with epoxy paint.
- F. Panels and breakers shall be rated for voltage and class of service to which applied.
- G. Spaces:
1. Space provisions or spaces for future breakers shall be located at the bottom of the panel and be fully bussed complete with all necessary mounting hardware less the breaker.
- H. Provide lugs as required for conductors being connected to panelboard lugs, circuit breakers, etc.

## 2.3 MAINS

- A. Provide main lug only (MLO) or main circuit breaker (MCB) as noted on drawings either by riser diagram or by schedule. Where conflict exists, provide MCB.
- B. Regardless of what is shown on drawings, provide the following minimum requirements.
  1. Main circuit breaker on each panel serving building main, if required by applicable codes.

2. Main circuit breaker on each panel fed directly from a transformer (unless disconnect with overcurrent devices is installed in feeder between transformer and panel).
- C. Provide lugs as required for conductors being connected to panelboard lugs, circuit breakers, etc.
- D. Main circuit breaker is not to be mounted as branch breaker or subfeeder breaker.

## 2.4 CIRCUIT BREAKERS

### A. General

1. Molded Case Circuit Breakers: Plug-in type for 250V or less, bolt-on type for over 250V, thermal magnetic trip circuit breakers, with common trip handle for all poles. Provide circuit breakers UL listed as Type SWD for lighting circuits. Provide UL Class A ground fault interrupter circuit breakers where scheduled. Do not use tandem circuit breakers.
2. Current Limiting Molded Case Circuit Breakers: Provide circuit breakers with integral thermal and instantaneous magnetic trip in each pole coordinated with automatically resetting current limiting elements in each pole. Interrupting rating 100,000 symmetrical amperes, let-through current and energy level less than permitted for same size Class RK-5 fuse.

### B. Main Breakers:

1. Main breakers shall be individually mounted separate from branch breakers.
2. Covered by a metal plate, except for operating handle.
3. Connection from the load's side to the panel bus shall be bus bar. Insulated wire not permitted.

### C. Branch Breakers:

1. Thermal-magnetic, molded case, with inverse time-current overload and instantaneous magnetic tripping, unless otherwise shown. Breakers shall be calibrated for 40 degrees C or shall be ambient compensating.
2. Quick-make, quick-break, with tripped indication clearly shown by breaker handle taking a position between ON and OFF.
3. Multi-pole breakers shall have common internal trip. No handle ties between single pole breakers are acceptable for this project.
4. Multi-wire branch circuit breakers shall have multi-pole breakers as required by the NEC. Handle ties between breaker handles are not acceptable.
5. Single pole 15 and 20 ampere circuit breakers shall be rated for switching duty and shall be labeled as "SWD."
6. AIC rating shall be as called for under "2.2 General."
7. Ground Fault Circuit Interrupters (GFCI):
  - a) Provide UL Class (5 milliamp sensitivity) ground fault circuit protection on 120 VAC branch circuits for exterior location receptacles and for interior locations where required by NEC. (These may not be indicated on Panel Schedule.) This protection shall be an integral part of the branch circuit breaker, which also provides overload, and short circuit protection for branch circuit wiring. Tripping of a branch circuit breaker containing ground fault circuit interruption shall not disturb the feeder circuit to the panelboard. Provide separate neutral for circuits on GFCI breakers whether indicated on drawings or otherwise.
8. Breakers feeding heating and air-conditioning equipment shall be rated HACR type

breaker.

9. Breakers feeding high intensity discharge lamps systems shall be HID rated.

D. All breakers are to have lugs sized to match conductors called for on drawings.

## 2.5 SERVICE ENTRANCE EQUIPMENT

A. Panelboards used as service entrance equipment shall be listed and labeled by UL for use as service equipment.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Install panelboards in accordance with NEMA PB 1.1. Install all panelboards and panelboard enclosures in accordance with the manufacturer's written instructions, NECA Standard of Installation, the applicable requirements of the National Electrical Code, and recognized industry practices.
- B. Install panelboards plumb. Install recessed panelboards flush with wall finishes. Provide supports in accordance with Section 16190 Hangers and Supports.
- C. Height: 6' to top of panelboard; install panelboards taller than 6' with bottom no more than 4" above housekeeping curb.
- D. Provide filler plates for unused spaces in panelboards.
- E. Provide typed circuit directory for each branch circuit panelboard. Mount a typewritten directory showing the actual circuit numbers, type of load and room names on inside of door. Room names shall be actual names or numbers used, not necessarily shown on the drawings. Progress drawings shall show same arrangements as the directory. Revise directory to reflect circuiting changes required to balance phase loads.
- F. Provide engraved plastic nameplates under the provisions of Section 16195 Identification for Electrical Systems.
- G. Provide spare conduits out of each recessed panelboard to an accessible location above ceiling. Minimum spare conduits: 4 empty 1". Identify each as "SPARE."
- H. Proper working clearances shall be maintained at every panelboard location. The working space in front of a panelboard shall be as a minimum, 30" wide extending 3', 3.5', or 4' (per NEC 110.26) out perpendicular to the panelboard.
- I. All enclosures shall be firmly anchored to walls and supporting structures (where used) using appropriate hardware. Provide supporting (unistrut type) channels on walls constructed of gypsum board or where otherwise necessary to provide a mechanically secure and permanent installation. Enclosures shall be installed so that the top is 6'-6" above finished floor. Where the size of the enclosure is such that the top cannot be installed at 6'-6", the top of the enclosure shall be kept as low as possible.
- J. Clean the interior of each panelboard before installing conductors. At all times, keep the interior trim and exterior surfaces of the panelboard free of rust and debris. Repaint finishes if necessary.
- K. Coordinate all raceways and conductors with their respective panelboards so that all connections and conductors routing present an orderly appearance. Conductors in the panelboards shall be laced and arranged in orderly manner.
- L. Collect all keys upon delivery of panelboard. Store keys on one ring to be kept by project superintendent. Forward key ring with keys to Owner upon substantial completion.
- M. Provide a separate neutral conductor for each GFI breaker. These shall not be combined to

serve more than one circuit, even when on different phases. Increase plan indications of conductors for neutral wires required as necessary.

### 3.2 IDENTIFICATION

- A. Refer to Section 16195 Identification for Electrical Systems for products and content.
- B. Provide engraved plastic nameplates under the provisions of Section Electrical Identification.
- C. Nameplate shall state panel name and voltage of this panel, name of panel that feeds this respective panel, and UL short-circuit rating of this panel.
- D. Provide labels and identification as required by the NEC.
- E. All circuit identifications and directories shall be checked to verify accuracy of the description of the load and/or equipment being fed

### 3.3 FIELD QUALITY CONTROL

- A. Field inspection and testing will be performed.
- B. Measure steady state load currents at each panelboard feeder; rearrange circuits in the panelboard to balance the phase loads to within 20 percent of each other. Maintain proper phasing for multi-wire branch circuits.
- C. Visual and Mechanical Inspection: Inspect for physical damage, proper alignment, anchorage, and grounding. Check proper installation and tightness of connections for circuit breakers, fusible switches, and fuses.
- D. Feeder conductors shall be checked by accepted means to establish the absence of shorts to ground, insulation value, etc., and the result recorded and submitted to the Engineer.
- E. All circuits shall be operated to establish a good working order and checked for shorts.
- F. All panel directory circuit numbers shall be checked to verify accuracy of the number.
- G. Where and when requested by Engineer provide:
  - 1. Inspection of equipment by authorized equipment manufacturer technician complete with submittal of statement of findings by technician, and providing any adjustments deemed necessary for a complete and operating system.
  - 2. Ground, voltage, and/or load readings complete with submittal on legible form with applicable data.

END OF SECTION



SECTION 16472 - DISTRIBUTION PANELBOARDS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Factory-assembled, metal-enclosed panelboard for distribution and control of power from incoming line terminals to outgoing feeder terminals, installed and tested in place.
- B. Distribution panelboard shall include all protective devices and equipment as listed on drawings or as included in these specifications, with necessary interconnections, instrumentation.

1.3 REFERENCES AND REGULATORY REQUIREMENTS

- A. ANSI/NFPA 70 National Electrical Code
- B. NEMA KS 1 Enclosed and Miscellaneous Distribution Equipment Switches (60 Volts Maximum)
- C. NEMA PB 2 Deadfront Distribution Switchboards
- D. NEMA PB 2.1 Proper Handling, Installation, Operation and Maintenance of Deadfront Switchboards Rated 600 Volts or Less
- E. UL 67 Panelboards
- F. UL 50 Enclosures for Electrical Equipment
- G. UL 489 Molded Case Circuit Breakers, Molded Case Switches, and Circuit Breaker Enclosures

1.4 REGULATORY REQUIREMENTS

- A. Conform to requirements of ANSI/NFPA 70.
- B. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and shown.

1.5 SUBMITTALS

- A. Submit under provisions of Section 16012 Submittals.
- B. Shop Drawings
  - 1. Shop drawings shall clearly indicate:
    - a) Front and side views of enclosures with overall dimensions shown.
    - b) Conduit entrance locations and requirements.
    - c) Nameplate legends.
    - d) Size and number of bus bars per phase, neutral, and ground.
    - e) Frame sizes and interrupting capacity of each breaker, and total assembly.
    - f) Horsepower ratings at rated voltage of fused switches and/or breakers.
    - g) Type of labels and labeling for every device and what it feeds.
    - h) Nameplate on main panelboard only giving name of project, Architect, Engineer and Contractor.

- i) Bus bar size, arrangement and spacing.
  - C. Product Data: Provide electrical characteristics including voltage, frame size and trip ratings, fault current withstand ratings, and time-current curves of all equipment and components.
  - D. Test Reports: Indicate results of factory production tests.
  - E. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency specified under "Regulatory Requirements." Include instructions for storage, handling, protection, examination, preparation, installation, and starting of product.
- 1.6 OPERATION AND MAINTENANCE DATA
- A. Submit Maintenance Data: Include spare parts data listing; source and current prices of replacement parts and supplies; and recommended maintenance procedures and intervals.
- 1.7 QUALIFICATIONS
- A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum 10 years experience.
- 1.8 DELIVERY, STORAGE, AND HANDLING
- A. Deliver, store and protect products at the site.
  - B. Deliver in sections as required to fit equipment through doors, individually wrapped for protection and mounted on shipping skids.
  - C. Accept switchboards on site. Inspect for damage.
  - D. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.
  - E. Handle in accordance with NEMA PB 2.1 and manufacturer's written instructions. Lift only with lugs provided for the purpose. Handle carefully to avoid damage to switchboard internal components, enclosure, and finish.
- 1.9 ENVIRONMENTAL REQUIREMENTS
- A. Conform to NEMA PB 2 service conditions during and after installation of switchboards.
- 1.10 FIELD MEASUREMENTS
- A. Verify that field measurements are as indicated and comply with instructions by manufacturer.
- 1.11 MAINTENANCE MATERIALS
- A. Provide two of each key (where applicable).
  - B. Provide two fuse pullers (where applicable).

## PART 2 - PRODUCTS

### 2.1 GENERAL

- A. Panelboards with circuit breaker, or fusible switch, branch protective devices shall comply with NEMA PB2 as a minimum requirement. Panelboards shall be NEMA I and shall meet Underwriter's Laboratories enclosure requirements for service conditions.
- B. Each cubicle shall have UL label affixed, unless special construction prohibits and no labeling or listing is available.
- C. See Drawings for acceptable manufacturers. Basis of design is Square D.
- D. Short-Circuit Rating Label:
  - 1. Minimum integrated short circuit rating, 10,000 amperes rms symmetrical for 240 volt,

14,000 amperes rms symmetrical for 480 volt. Bus shall be braced for minimum capacity equal to or greater than the lowest breaker symmetrical interrupting capacity. Minimum short circuit rating shall be increased to meet the following requirements:

- a) Individual circuit breaker AIC rating shown on panel schedules indicate lowest AIC rating allowed for individual circuit breaker in panel.
  - b) Panel series AIC rating shown is the required rating of panel and its circuit breakers based on series rating of individual panel circuit breakers with panel main circuit breaker or upstream feeder breaker.
  - c) Circuit breaker types are not shown or called for. The Contractor must provide breakers in panel or feeder breakers in upstream breakers to comply with the required AIC ratings given, including providing current limiting breakers where required to achieve all ratings given.
- E. When series ratings are applied with integral or remote upstream devices, a label or manual shall be provided. It shall state the conditions of the UL series ratings including:
1. Size and type of upstream device
  2. Branch devices that can be used
  3. UL series short-circuit rating
- F. Provide lugs on bus, distribution panelboard and circuit breakers as required to match conductors being connected/terminated.

## 2.2 MANUFACTURERS

- A. Basis of Design: Square D
- B. Approved Equivalents: General Electric or Siemens.
- C. Manufacturers (including accepted substitutions) must provide equipment equal to or superior than the basis of design used on this project.

## 2.3 DISTRIBUTION PANELBOARDS

- A. Description: NEMA PB 2 with electrical ratings and configurations as indicated.
- B. Main Section Devices: Panel mounted.
- C. Distribution Section Devices: Panel mounted.
- D. Bus Material: Aluminum with tin plating or Copper standard size.
- E. Bus Connections: Bolted, accessible from front for maintenance.
- F. Ground Bus: Extend length of board.
- G. Molded Case Circuit Breakers: Integral thermal and instantaneous magnetic trip in each pole. Provide circuit breakers UL listed as Type HACR for air conditioning equipment branch circuits.
- H. Molded Case Circuit Breakers with Current Limiters: Molded case circuit breakers with replaceable current limiting elements, in addition to integral thermal and instantaneous magnetic trip in each pole.
- I. Current Limiting Molded Case Circuit Breakers: Molded case circuit breakers with integral thermal and instantaneous magnetic trip in each pole, coordinated with automatically resetting current limiting elements in each pole. Interrupting rating 100,000 rms amperes symmetrical let-through current and energy level less than permitted for same size Class RK-5 fuse.
- J. Solid-State Molded Case Circuit Breakers: Provide with electronic sensing, timing and

- tripping circuits for adjustable current settings; [ground fault trip]; instantaneous trip; and adjustable short time trip. Provide ground fault sensing integral with circuit breaker. Provide zero sequence type ground fault sensor.
- K. Line and Load Terminations: Accessible from the front only of the switchboard, suitable for the conductor materials and sizes indicated.
  - L. Ground Fault Sensor: (Where called for on Drawings) Zero sequence or ground return type.
  - M. Ground Fault Relay: (Where called for on Drawings) Adjustable ground fault sensitivity from 200 to 1200 amperes, time delay adjustable from 0 to 15 seconds. Provide monitor panel with lamp to indicate relay operation, TEST and RESET control switches.
  - N. Future Provisions: Fully equip spaces for future devices with bussing and bus connections, suitably insulated and braced for short circuit currents. Provide continuous current rating as indicated.
  - O. Enclosures:
    - 1. Type 1 General Purpose for interior locations.
    - 2. Type 2 Raintight for exterior locations.
    - 3. Align sections at front and rear.
    - 4. Finish:
      - a) Interior: Manufacturer's standard light gray enamel over external surfaces. Coat internal surfaces with minimum one coat corrosion-resisting paint, or plate with cadmium or zinc.
      - b) Exterior: Coat interior and exterior of enclosure with rust inhibiting primer and paint over with epoxy paint
    - 5. Enclosures shall be at least 20" wide made from galvanized steel. Provide minimum gutter space in accordance with the National Electrical Code. Where feeder cables supplying the mains of a panel are carried through its box to supply other electrical equipment, the box shall be sized to include the additional required wiring space. At least four interior mounting studs with adjustable nuts shall be provided.
    - 6. Enclosures shall be provided with blank ends.
    - 7. Where indicated on the Drawings, branch circuit panelboards shall be column width type.
  - P. Breakers
    - 1. All breakers are to have lugs sized to match conductors called for on Drawings.
    - 2. Main circuit breaker is not to be mounted as branch breaker or subfeed breaker.
    - 3. Breakers feeding heating and air conditioning equipment shall be rated HACR type breaker.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Verify that surface is suitable for distribution panelboard installation.

#### 3.2 PREPARATION

- A. Provide concrete housekeeping pad.

#### 3.3 INSTALLATION

- A. Install distribution panelboard in locations shown on Drawings, in accordance with

manufacturer's written instructions and NEMA PB 2.1.

- B. Tighten accessible bus connections and mechanical fasteners after placing switchboard.
- C. Install fuses in each switch (where applicable).

#### 3.4 FIELD QUALITY CONTROL

- A. Field inspection and testing shall be performed under provisions of Section 16090 Tests and Performance Verification of Electrical System.
- B. Inspect completed installation for physical damage, proper alignment, anchorage, and grounding.
- C. Measure insulation resistance of each bus section phase to phase and phase to ground for one minute each, at test voltage of 1000 volts; minimum acceptable value for insulation resistance is 2 megohms.
- D. Check tightness of accessible bolted bus joints using calibrated torque wrench.

#### 3.5 ADJUSTING

- A. Adjust all operating mechanisms for free mechanical movement.
- B. Tighten bolted bus connections in accordance with manufacturer's instructions.
- C. Adjust circuit breaker trip and time delay settings to values as instructed by the Architect/Engineer or (if so directed by A/E) as manufacturer's recommendation.

#### 3.6 CLEANING

- A. Touch up scratched or marred surfaces to match original finish.

#### 3.7 LABELING

- A. Refer to Section 16195 Identification for Electrical Systems for products and content.
- B. Provide engraved plastic nameplates under the provisions of 16195 Identification for Electrical Systems.
- C. Nameplate shall state panel name and voltage of this panel, name of panel that feeds this respective panel, and UL short-circuit rating of this panel.
- D. Provide labels and identification as required by the NEC.
- E. Each circuit breaker shall have engraved nameplate describing load/equipment being fed by breaker.
- F. All circuit identifications/nameplates shall be checked to verify accuracy of the description of the load and/or equipment being fed.

END OF SECTION

SECTION 16484 - MOTOR CONTROL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section of the Specification covers factory-assembled, metal-enclosed motor control units for distribution and control of power from incoming line terminals to outgoing feeder terminals, installed and tested in place.
- B. Motor control units shall include all protective devices and equipment as listed on Drawings or as included in these Specifications, with necessary interconnections, instrumentation, and control wiring.

1.3 FURNISHING OF EQUIPMENT

- A. Unless specifically noted otherwise, automatic motor starters for all equipment requiring them shall be furnished under the section or division where equipment is specified, and installed under this Section of the Specifications.
- B. Provide all labor, materials, and equipment necessary to properly install all motor starters. Provide motor starters for all new motors to be wired, where starters are not elsewhere specified under work of that division which provides the motored equipment.
- C. Unless specifically noted otherwise manual motor starters shall be furnished and installed under this Section of the Specifications.
- D. Disconnect switches for 120V fractional hp exhaust fans to be provided by Division 15 Contractor at exhaust fan. Any other required disconnect switch to be provided and installed by Division 16 Contractor.
- E. Motor control center and associated starters shall be provided (under this section) or (by Division 15) of the Specifications.
- F. Provide and install 75 degree rated lugs on all non-unitary mechanical equipment such as pumps, air handling units and individual motor units/equipment. Coordinate with Division 15 Contractor prior to bid.
- G. Where a disconnect switch is mounted between an adjustable frequency drive and the motor, the disconnect must have a late make, early break auxiliary contact. This contact shall be wired into the AFD control circuit so that the control circuit is disconnected before the power circuit is broken

1.4 CONTROL ITEMS

- A. Unless specifically noted otherwise, all control, alarm and interlock wiring required for proper operation of equipment furnished by any other contractor and the required raceways shall be furnished and installed under the division where the equipment is specified.
- B. Where required by Electrical Drawings, Division 15 Specification, and/or Mechanical Drawings, this Contractor shall connect power feeder to mechanical equipment via control devices furnished by Division 15 Contractor (i.e. starters, line voltage, t'stats, line voltage switch, control relays, etc.).
- C. Provide and install power circuits to all control devices requiring them (i.e. 120V dampers, control panels, control devices, etc.) whether shown on Drawings or not. Coordinate requirements of all Divisions and/or Sections of these Specifications prior to bid.

## 1.5 SUBMITTALS

### A. Shop Drawings and Product Data:

#### 1. Shop Drawings, Individually mounted AC Manual Starter:

##### a) Shop Drawings shall clearly indicate:

1. Frame sizes and Interrupting Capacity of manual starter and/or disconnect unit.
2. Horsepower rating at rated voltage of manual starter and/or disconnect unit.
3. Electrical ratings.
4. Single line diagram for power and control connections with numbered terminals and all required accessories.
5. All required accessories.

#### 2. Shop Drawings, Individually mounted AC Magnetic Starter:

##### a) Shop Drawings shall clearly indicate:

1. Frame sizes and interrupting capacity of starter and/or disconnect unit.
2. Horsepower rating at rated voltage of starter and/or disconnect unit.
3. Electrical ratings.
4. Single line diagram for power and control connections with numbered terminals and all required accessories.
5. All required accessories.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

#### A. Basis of Design:

1. Square D

#### B. Accepted Substitutions:

1. General Electric
2. Siemens/ITE

### 2.2 GENERAL

- A. Motor starters shall be manual, magnetic, or combination type as denoted on the Drawings.
- B. Pilot lights shall have long-life lamps rated 7500 hours minimum.
- C. Enclosures shall be NEMA 1 for indoor locations and NEMA 3R for outdoor or wet locations except where indicated as NEMA 4.
- D. Multi-speed or stop type controllers shall have thermal overload relays in each ungrounded conductor for each speed or step.
- E. Where multi-speed motors are scheduled on the Drawings, the motor controls shall be compatible with the type motor and have adjustable time deceleration for transition from high to low speeds.

### 2.3 INDIVIDUALLY MOUNTED AC MANUAL STARTERS

- A. Where manual motor starter switch is called for on Drawings, it shall be a combination across-the-line manual type starter with overloads and disconnect rated in accordance with NEMA standards, sizes and horsepower rating. Final rating of overloads shall be field set and

recorded. Unit shall be mounted on NEMA 1 enclosures, unless otherwise noted.

- B. Manual motor starter switch shall include green "run" pilot light, and shall be surface or flush mounted as noted on Drawings.

#### 2.4 INDIVIDUALLY MOUNTED AC MAGNETIC STARTERS

##### A. Combination Starter and Disconnect:

- 1. Where combination starter and disconnect switch is called for on Drawings, it shall be a combination across-the-line magnetic type starter with motor circuit protection (magnetic only breaker) disconnect, rated in accordance with NEMA standards, sizes and horsepower rating. Final magnetic setting of MCP shall be field set and recorded with unit shall be mounted on NEMA 1 enclosures, unless otherwise noted.

##### B. Individual Starter Without Disconnect:

- 1. Where individually mounted starter is called for on Drawings, it shall be across-the-line magnetic type rated in accordance with NEMA standards, sizes, and horsepower ratings. Unit shall be mounted on NEMA 1 enclosure, unless otherwise noted.

##### C. Starters:

- 1. Motor starter, unless otherwise noted, shall be across-the-line magnetic type rated in accordance with NEMA standards, sizes, and horsepower ratings. Starters shall be equipped with double break silver alloy contacts. All contacts shall be replaceable from front without removing starter from enclosure. Overload relays shall be provided in each phase, and shall be melted alloy or bimetallic type. Thermal units shall be of the one-piece construction and interchangeable.
- 2. Starters shall be equipped with minimum of two (normally open) auxiliary contacts in addition to the normally open auxiliary seal-in interlock and shall be suitable for the addition of at least two additional external electrical interlocks, one normally open and one normally closed. All starters shall have red "run" pilot light, "Hand-Off-Auto" selector switch, and nameplate. Control voltage shall be as required. Starters shall contain fused control transformers to provide correct control voltage.
- 3. Starter for all 3-phase motors shall include 3-phase power monitor as manufactured by Time Mark Corporation (Model #A258B for 480V, 3 phase system) (Model #258B for 208V/240V, 3 phase system) (Model #B258B for 120V system) providing solid state protection by opening starter for loss of any phase, low voltage of any or all phases, and phase reversal. Monitor shall be field adjustable for drop-out voltage of (340-480VAC) (160-240VAC) (85-125VAC).

### PART 3 - EXECUTION

#### 3.1 INSPECTION

- A. Examine area to receive motor-control units to assure adequate clearance for motor control unit installation.
- B. Start work only after unsatisfactory conditions are corrected.
- C. Check that concrete pads are level and free of irregularities for motor control centers.

#### 3.2 INSTALLATION

- A. Install motor control units in accordance with manufacturer's written instructions and NEC.
- B. All starters and their respective enclosures shall be firmly anchored to walls and supporting structures (where used) using appropriate hardware. Provide supporting (unistrut type) channels on walls constructed of gypsum board or where otherwise necessary to provide a mechanically secure and permanent installation. Starters shall be installed with their turning axis of their



handles approximately 5'-0" above finished floor. Provide rigid steel (galvanized for exterior use) mounting stands, brackets, plates, hardware, and accessories for a complete installation.

- C. Starters shall be mounted where shown on the Drawings. Where the starter also provides the code-required disconnecting means for a load, the starter shall be located within sight of the load and as close as feasible.
- D. Provide fusing for all fusible switches.
- E. Provide properly sized heater elements for every starter overload relay. The element shall be sized using the nameplate full load running current of the actual equipment supplied to the job.
- F. Provide a heater element selection chart on the inside of each starter door.
- G. Provide spare pilot light lamps to the Owner. Provide two of each type and size load.
- H. Provide nameplate for each control units.
- I. Provide and install 75 degree rated lugs on all non-unitary mechanical equipment such as pumps, air handling units and individual motor units/equipment. Coordinate with Division 15 Contractor prior to bid.
- J. Coordinate conductor terminations on all equipment connections. Replace all 60 degree lugs/connections with 75 degree lug/connection.

### 3.3 ADJUSTMENT AND CLEANING

- A. Adjust operating mechanisms for free mechanical movement.
- B. Touch-up scratched or marred surfaces to match original finish.
- C. Tighten bus connections and mechanical fasteners.

### 3.4 IDENTIFICATION

- A. Refer to Section 16195 Identification for Electrical Systems.
- B. Provide engraved plastic nameplates under the provisions of Section 16195 Identification for Electrical Systems.
- C. Provide labels and identification as required by the NEC.
- D. Nameplate shall show panel name, voltage and name of panel that feeds each motor starter device, and UL short circuit rating.
- E. Each motor starter device shall have engraved nameplate describing load/equipment being fed by device.
- F. All circuit identifications/nameplates shall be checked to verify accuracy of the description of the load and/or equipment being fed.

END OF SECTION

SECTION 16491 - AUTOMATIC TRANSFER SWITCH

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Automatic transfer switches shall be provided as described herein and shown on Drawings. The transfer switch shall be capable of switching all classes of load, and shall be rated for continuous duty when installed in a nonventilated enclosure.
- B. Transfer switches shall be a true 4-pole type. The normal and emergency full load current and voltage ratings at 60 cycles shall be as called for on Drawings.

1.3 QUALITY ASSURANCE/TESTS

- A. As a precondition for approval, transfer switch, complete with timers relays and accessories shall be listed by Underwriters Laboratories in their Electrical Construction Materials Catalog under UL1008 Standard for Transfer Switch Equipment, and accepted for use on emergency systems.
- B. When conducting temperature rise tests to paragraph 99 of UL1008, the manufacturer shall include post-endurance temperature rise tests to verify the ability of the transfer switch to carry full rated current after completing the overload and endurance tests.
- C. The switch shall meet or exceed the voltage surge withstand capability in accordance with IEEE Standard C37.90 and the impulse withstand voltage test in accordance with NEMA Standard ICS 1-109.

1.4 SHOP DRAWINGS

- A. Submit shop drawings and product data clearly indicating:
  - 1. Cabinet dimensions.
  - 2. All applicable options and accessories.
  - 3. Wiring diagrams.
  - 4. Interrupting or withstanding current rating.
  - 5. All electrical characteristics and data as required to show compliance with these specifications.

PART 2 - PRODUCTS

2.1 GENERAL

- A. The transfer switch shall be double throw, actuated by two electrical operators, momentarily energized and connected to the transfer mechanism by a simple overcenter linkage with time delay relays to control contact transition time on transfer to either source, adjustable 0-300 seconds. Time delay between the opening of the closed contacts and the closing of the open contacts shall be adjusted to allow for voltage decay before transfer as required to allow re-energization of motor and transformer loads at normal inrush currents. Single throw, actuated by single electric operator shall be allowed in lieu of double throw operator if in phase monitor is used which allows for re-energization as noted above.
- B. The transfer switch shall be capable of transferring successfully in either direction with 70 percent of the rated voltage applied to the switch terminals. The normal and emergency contacts shall be positively interlocked mechanically and electrically to prevent simultaneous closing. Main contacts shall be mechanically locked in position in both the normal and

emergency positions without the use of hooks, latches, magnet, or springs and shall be silver-tungsten alloy protected by arcing contacts, with magnetic blowouts on each pole. Parallel main contacts are not acceptable.

- C. The transfer switch shall be equipped with a safe manual operator designed to be operated in the loaded condition and to prevent injury to operating personnel. The manual operator shall provide the same contact-to-contact transfer speed as the electrical operator to prevent a flashover from switching the main contacts slowly.
- D. Engine starting contacts shall be provided in transfer switch to start the generating plant if any phase of the normal source drops below 80 percent of rated voltage, after an adjustable time delay period of 0.5-3 seconds, to allow for momentary dips. The transfer switch shall not transfer to emergency until the generator source voltage and frequency have reached 90 percent of rated. After restoration of normal power on all phases to 90 percent of rated voltage, adjustable time delay period of 0-25 minutes shall delay transfer to normal power until it has had time to stabilize. If the emergency power source should fail during the time delay period, the time delay shall be by-passed, and the switch shall return immediately to the normal source. Whenever the switch has retransferred to normal, the engine-generator shall be allowed to operate at no load for a fixed period of time (5 minutes) to allow it to cool before shut-down. The transfer switch shall include a test switch to simulate normal power failure with actual load transfer. Pilot lights shall be included on the cabinet door to indicate the main switch closed on normal or emergency, and two auxiliary contacts on the main shaft; one closed on normal, the other closed on emergency. In addition, two sets of relay contacts shall be provided to open and close upon loss of the normal power supply. All relays, timers, control wiring and accessories to be front accessible and be rated for the load and voltage as required for auxiliary control functions.
- E. The transfer switch shall be UL listed for withstand and close-in values at least equal to the interrupting rating of the circuit breaker and/or fuse that is specified to protect the circuit, and available short circuit amps from the generator set.
- F. The transfer switch shall include an exerciser with seven day dial to automatically exercise the generating plant in the loaded condition. Exerciser shall be adjustable in 15 minute increments and shall be set for 20 minutes minimum each week unless otherwise noted.
- G. Transfer switches shall transfer to emergency within the time limits as required by the National Electrical Code for each branch of emergency (10 seconds for life safety, 60 seconds for critical).
- H. When more than one emergency branch is shown, time delay relays shall be provided on the transfer to emergency operation for critical and equipment branch transfer switches. Time delay shall be adjustable 1-300 seconds and shall be adjusted in stages with the limits of the NEC and as follows:
  - 1. Life Safety Branch - no time delay on transfer to emergency.
  - 2. Critical Branch - shall transfer to emergency after life safety branch has transferred to emergency and generator has recovered to 90 percent of rated voltage and frequency.
  - 3. Equipment Branch - shall transfer to emergency after critical branch has transferred to emergency and generator has recovered to 90 percent of rated voltage and frequency.
  - 4. NOTE: These time delays shall not effect or be a function of contact transition time as required in A. above.
- I. Transfer switch maximum dimensions shall be as shown on Drawings.
- J. Acceptable Manufacturers:
  - 1. ASCO

2. Russel Electric

PART 3 - EXECUTION

3.1 INSTALLATION

- A. The transfer switch shall be installed as shown on the Drawings, in accordance with the manufacturer's recommendations and all applicable codes. Provide all associated control wiring to generator as required.
- B. Provide all interface control wiring and conduit as required to provide required emergency operation of equipment on project as applicable, i.e. elevators, etc.

3.2 SITE TEST

- A. An installation check and building load test shall be performed by the manufacturer's local representative. The Engineer, regular operators, and the maintenance staff shall be notified of the time and date of the site test. The tests shall include Automatic start-up by means of simulated power outage to test remote-automatic starting, transfer of the load and automatic shutdown. Prior to this test, all transfer switch timers shall be adjusted for proper system coordination.

3.3 LOAD BANK TEST

- A. After the building load test, a load bank test will be performed. This test shall be done with resistive dry load banks, in the presence of the Engineer and Owner. Test shall be performed during regular hours and days only Monday through Friday, 8:00 am to 5:00 pm.
  - 1. 1 hour 50 percent
  - 2. 1 hour 75 percent
  - 3. 3 hours 100 percent
  - 4. 10 minutes cooldown
- B. During test a written log shall be maintained at 15-minute intervals with the following:
  - 1. Ambient Air Temperature
  - 2. Amperes
  - 3. Hertz
  - 4. Oil Pressure
  - 5. Water Temperature
  - 6. Battery Charging
  - 7. Exhaust Stack Temperature
  - 8. Noise Level in dba (each side)
  - 9. Fuel for load test to be included in bid

END OF SECTION

SECTION 16510 - INTERIOR LIGHTING FIXTURES, LAMPS AND BALLASTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes:
  - 1. Interior luminaires and accessories
  - 2. Exit signs
  - 3. Ballasts
  - 4. Lamps
  - 5. Luminaire accessories
  - 6. Fluorescent dimming ballasts
- B. Light fixtures furnished under this Division shall be furnished complete with lamps and all necessary trim and mounting hardware, and installed as shown on the Drawings.
- C. Light fixtures shall be neatly and firmly mounted, using standard supports for outlets and fixtures.
- D. Lamps shall be included in the system guarantee for a period of thirty days after final acceptance of the building.

1.3 REFERENCES

- A. ANSI C78.379 Classification of Beam Patterns of Reflector Lamps
- B. ANSI C82.1 Lamp Ballast – Line Frequency Fluorescent Lamp Ballast
- C. ANSI C82.4 Ballasts for High-Intensity Discharge and Low Pressure Sodium Lamps (Multiple-Supply Type)
- D. ANSI/NFPA 70 National Electrical Code
- E. ANSI/NFPA 101 Life Safety Code
- F. NEMA WD 6 Wiring Devices - Dimensional Requirements

1.4 REGULATORY REQUIREMENTS

- A. Conform to requirements of:
  - 1. ANSI/NFPA 70
  - 2. NFPA 101
  - 3. ADA
  - 4. Furnish products listed and classified by Underwriters Laboratories as suitable for purpose specified and shown.

1.5 SUBMITTALS

- A. Shop Drawings: Indicate dimensions and components for each luminaire that is not a standard product of the manufacturer.
  - 1. Shop drawings shall be submitted for all fixtures that require modifications, either as specified or as required to fit architectural field conditions of this project (i.e., luminous

ceiling, wall/slot fixtures, special fixtures).

2. Shop drawings shall be complete showing all dimensions and installation instructions required for conditions on this project.
- B. Product Data: Provide dimensions, ratings, and performance data. Product data shall be submitted for all light fixtures showing:
1. Dimensions
  2. UL label
  3. Fusing
  4. Luminaire disconnect
  5. Metal gauge
  6. Lens/louvre thickness
  7. Finish
  8. Voltage
  9. Lamps
- 1.6 OPERATION AND MAINTENANCE DATA
- A. Submit Maintenance Data and include replacement parts list.
- 1.7 MANUFACTURER'S QUALIFICATIONS
- A. Company specializing in manufacturing products specified in this Section with minimum five years experience.
- 1.8 PRODUCT STORAGE AND HANDLING
- A. Physically protect fixtures against damage as recommended by manufacturer.
- 1.9 MAINTENANCE MATERIALS
- A. Provide to Owner:
1. Ten of each size/type of fuses.
  2. Six of each type of lamps.
  3. One carton or twenty-four (whichever is greater) in manufacturer's carton of 4' T8 lamps.
- 1.10 WARRANTY
- A. All ballasts furnished under this Division shall be covered by a warranty against defects. Warranty shall include payment for normal labor costs of replacement of inoperative in-warranty ballasts.

## PART 2 - PRODUCTS

### 2.1 LUMINAIRES/FIXTURES

- A. Furnish products as specified in schedule on Drawings.
- B. Install ballasts, lamps, and specified accessories at factory.
- C. All light fixtures shall adhere to UL Test Standard 1598 and NEC 410.115(C). All manufacturers shall provide the required thermal protection as required.

### 2.2 LAMPS

- A. Manufacturers:

1. Sylvania, G.E., or Phillips.
- B. Incandescent:
  1. Lamps to be rated and stamped for 130 volts.
  2. Provide type specified for luminaire/fixture on drawings.
  3. Reflector lamp beam patterns: ANSI C78.379.
- C. Fluorescent:
  1. Fluorescent lamps to be Octron type, T8 bulb with medium bi-pin base.
  2. Correlated color temperature shall be 4100K with color rendering index of 80 minimum
- D. Compact Fluorescent:
  1. General:
    - a) Provide complete with starter, ballast, etc.
    - b) Suitable for low starting temperatures 32 degree F. and below.
  2. Twin Tube Type:
    - a) T4 bulb.
    - b) 5, 7, 9, or 13 watt lamps as called for on Drawings.
    - c) 4100K temperature.
    - d) Color rendering index: 80 minimum.
  3. Double Twin (quad) Tube Type:
    - a) T4 bulb.
    - b) 9, 13, 18 or 26 watt lamps as called of on drawings.
    - c) 4100K temperature.
    - d) Color rendering index: 75 minimum.

## 2.3 BALLASTS

- A. Manufacturers:
  1. Magnetek, Advance, or accepted substitution.
- B. Fluorescent Ballast:
  1. Provide ballast suitable for lamps specified.
  2. Voltage: Match luminaire voltage and voltage of system to which applied.
  3. Ballast to be protected with in-line fuse/fuseholder.
  4. Provide disconnecting means for ballast that simultaneously disconnects all supply conductors to the ballast, including the grounded conductor.
  5. Ballasts installed outdoors or in cool temperatures to be 0 degree ballasts.
- C. Electronic Ballasts:
  1. Fluorescent lamp ballasts shall be high frequency electronic type, operating lamps at a frequency of 20 kHz or higher with no detectable flicker.
  2. Ballasts shall not be affected by lamp failure and shall yield normal lamp life.
  3. Lamp current crest factor shall not exceed 1.6.

4. Ballasts shall operate at an input frequency of 60 Hz and an input voltage of 108 to 132 (120V models) or 249 to 305 (277V models).
  5. Ballasts shall have power factor above 95 percent.
  6. Ballasts that operate as a parallel circuit shall allow remaining lamp(s) to maintain full output if companion lamp(s) fail.
  7. Ballasts shall carry five-year warranty, including labor allowance.
  8. Ballast manufacturers shall have been producing electronic ballasts in the US for more than ten years with a low failure rate.
  9. Ballasts shall be accepted and listed by Underwriters Laboratories.
  10. Ballasts shall comply with all applicable state and federal efficiency standards.
  11. Ballasts shall comply with FCC and NEMA limits governing electromagnetic and radio frequency interference and shall not interfere with operation of other normal electrical equipment.
  12. Ballasts shall meet all applicable ANSI and IEEE standards regarding harmonic distortion and surge protection.
  13. Total harmonic distortion (THD) to be less than 20 percent and shall have a passive power factor corrective front end.
  14. 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 2-lamp fixture, two ballasts per 3-lamp or 4-lamp fixture.
- D. High Intensity Discharge (HID) Ballast:
1. Description: ANSI C82.4 high power factor type lamp ballast to match lamp.
  2. Provide ballast suitable for lamp specified.
  3. Voltage: Match luminaire voltage and voltage of system to which applied.
  4. Ballast to be protected with in-line fuse/fuseholder.
- E. Dimming Ballast:
1. Furnish dimming ballasts in specified luminaires.
  2. Use ballast selected by dimming system manufacturer as suitable for operation with control unit.
  3. Lamps: Suitable for lamp type and quantity specified for luminaire.
- 2.4 EXIT SIGNS (See Section 16535 Emergency Lighting Equipment for self-contained emergency power exit signs).
- A. Description: Exit sign fixture suitable for use as emergency lighting unit.
  - B. Maximum of 5 Watts.
  - C. Exit signs to have long life LED lamps for normal and emergency operation.
  - D. Exit sign shall have universal mount, universal arrows, down light, stencil face. Arrows shall be as shown on drawings.
  - E. Transformer shall be dual rated for 120 or 277 volt.
  - F. Furnish all lamps required.



- G. Install suspended exit signs using pendants supported from swivel hangers.
- H. Mount all exit signs at 7'-6" AFF or as required to meet ADA requirements. Provide all mounting accessories/hardware as required for proper mounting including pendant/swivel hangers.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine substrate and supporting grids for luminaires.
- B. Examine each luminaire to determine suitability for lamps specified.

#### 3.2 INSTALLATION

- A. Install in accordance with manufacturer's instructions and NEC.
- B. Install suspended luminaires and exit signs using pendants supported from swivel hangers. Provide pendant length required to suspend luminaire at indicated height.
- C. Support luminaires larger than 2' x 4' size independent of ceiling framing.
- D. Locate recessed ceiling luminaires as indicated on reflected ceiling plan.
- E. Install surface mounted luminaires and exit signs plumb and adjust to align with building lines and with each other. Secure to prohibit movement.
- F. Exposed Grid Ceilings: Support surface mounted luminaires on grid ceiling directly from building structure.
- G. Install recessed luminaires to permit removal from below.
- H. Install recessed luminaires using accessories and firestopping materials to meet regulatory requirements for fire rating.
- I. Recessed luminaires not rated for contact with insulation (Type IC) shall not be installed within 3" of any insulation or as required by the NEC. All recessed luminaires installed within three inches of insulation shall be identified for contact with insulation and bear the UL Type IC label.
- J. Install wall mounted luminaires and exit signs at height as indicated on Drawings, or as required by ADA, local codes and state codes. Where conflict exists between what is shown on drawings and what is required by codes, install fixture as required by codes.
- K. Install accessories furnished with each luminaire.
- L. Connect emergency lighting fixtures per Section 16535 Emergency Lighting Equipment.
- M. Make wiring connections to branch circuit using building wire with insulation suitable for temperature conditions within luminaire.
- N. Bond products and metal accessories to branch circuit equipment grounding conductor.
- O. Install specified lamps in each luminaire and exit sign.
- P. Where ceiling mounted fixtures are called for in the Light Fixtures Schedule and on the Drawings, this Contractor shall provide fixture trims and supports as required to match type of ceiling system which will be furnished. No ceiling fixtures shall be ordered until the Ceiling System Installer has given written acceptance of the method and location of fixture hanging and fixture type.
- Q. Fixtures supported by suspended ceiling systems shall be securely fastened to the ceiling framing member by mechanical means such as bolts, screws, or rivets. Clips identified and listed for use with the type of ceiling framing member(s) and fixture(s) shall also be permitted. Ceiling framing members must be securely attached to each other and to the building structure as required by all applicable codes and standards.

- R. All interior and exterior light fixtures shall not have any labels exposed to normal viewing angles. This includes manufacturer's labels and UL labels. All labels shall be concealed within the body of the fixture and/or luminaire. Manufacturer's name or logo shall not appear on the exterior of any light fixtures unless accepted in writing by the Engineer.
- S. Miscellaneous (provide and install complete):
  - 1. Dimming ballasts for all fluorescent lights connected to dimming circuits as required to match dimmer unit/system.
  - 2. Low voltage transformers for all low voltage light fixtures.
  - 3. Tents as required for fixtures in fire rated ceilings as per applicable codes.
  - 4. Thermal protection for all fixtures with tents or fixtures surrounded by insulation as per applicable codes.
  - 5. Zero degree ballast for outdoor lighting fixtures.
  - 6. Heat removal or air supply slot covers for all fixtures requiring them as determined by Mechanical Engineer.
- T. Ceiling surface mounted fluorescent fixtures installed in exposed ceiling areas are to be suspended from ceiling structure with minimum 3/8" all-thread rods and 1-1/2" x 1-1/2" Kindorf channels, full length of fixture/row. Mount outlet box at structure with flexible connection to fixture.
- U. Coordinate fixtures installed in mechanical rooms with piping and ductwork prior to installation and relocate fixtures as required to provide proper illumination and access.
- V. Electrical Contractor shall remotely locate all transformers called for in these Specifications in a well ventilated and easily accessible space to comply with all codes. Revise circuitry as shown on plans as required to facilitate transformer/fixture location.
- W. Voltage for all fixtures shall match the voltage of the lighting circuit fixture is connected to. Coordinate with Electrical Drawings.
- X. All light fixtures shall have label near lamp socket, out of view of public stating maximum wattage of lamp allowed in fixture. Maximum wattage to be stated is wattage as shown on schedule of lighting equipment herein. Circuits are based on these wattages, circuitry, etc. Any failure to comply with this requirement shall be responsibility of contractor. Location of labels must meet acceptance of Lighting Designer, Architect and Engineer.
- Y. Verify all fluorescent fixtures have a luminaire disconnect. Provide luminaire disconnect in any luminaires where factory failed to install luminaire disconnect.

### 3.3 EXIT SIGNS

- A. Install illuminated exit signs as shown on Drawings, as herein specified or as required by applicable codes.
- B. Connect exit sign to local lighting circuit ahead of all switches.
- C. Install suspended exit signs using pendant supported from swivel hangers.
- D. Mount all exit signs at 7'-6" AFF or as required to meet ADA requirements. Provide all mounting and accessories/hardware as required for proper mounting including pendant/swivel hangers.

### 3.4 ADJUSTING

- A. Aim and adjust luminaires as directed.
- B. Adjust exit sign directional arrows as indicated.
- C. Relamp luminaires that have failed lamps at Substantial Completion.

3.5 CLEANING

- A. Clean electrical parts to remove conductive and deleterious materials.
- B. Remove dirt and debris from enclosure.
- C. Clean photometric control surfaces as recommended by manufacturer.
- D. Clean finishes and touch up damage.

3.6 DEMONSTRATION

- A. Provide demonstration of luminaire operation.

3.7 FIELD QUALITY CONTROL

- A. Operate each luminaire after installation and connection. Inspect for proper connection and operation.

3.8 CLEAN-UP

- A. Luminaires:
  - 1. Clean free from dust and dirt. Wash lens and glassware using cleaner such as Windex and dry with absorbent paper. Clean plastic per manufacturer's recommendations; do not wipe. Lenses which are kept in original containers until immediately prior to final inspection may not require cleaning. Clean Alzak aluminum surfaces (reflectors, fixture cones) per manufacturer's recommendations being careful to remove finger prints and smudges.
  - 2. It is the Contractor's responsibility to remove any UL labels or manufacturers labels from areas of fixture exposed to view and relocate label to non-obtrusive area on fixture.

END OF SECTION

SECTION 16530 - EXTERIOR LUMINAIRES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes:
  - 1. Exterior luminaires and accessories.
  - 2. Poles.
- B. Light fixtures furnished under this Division shall be furnished complete with lamps and all necessary trim and mounting hardware, and installed as shown on the Drawings.
- C. Light fixtures shall be neatly and firmly mounted.
- D. Lamps shall be included in the system guarantee for a period of thirty days after final acceptance of the project.
- E. Provide and install concrete base as noted on Drawings. Construct concrete base per applicable section and/or division of the specifications.

1.3 REFERENCES

- A. ANSI C78.379 Classification of Beam Patterns
- B. ANSI C82.1 For Lamp Ballast – Line Frequency Fluorescent Lamp Ballast
- C. ANSI C82.4 Ballasts for High-Intensity-Discharge and Low-Pressure Sodium Lamps (Multiple-Supply Type)
- D. ANSI O5.1 Wood Poles, Specifications and Dimensions
- E. IES RP-8 Roadway Lighting
- F. IES RP-20 Lighting for Parking Facilities

1.4 REGULATORY REQUIREMENTS

- A. Conform to requirements of the following:
  - 1. ANSI/NFPA 70 National Electrical Code
  - 2. FBC Florida Building Code
  - 3. ASCE 7-10 Minimum Design Loads for Building and Other Structures
  - 4. IES Illuminating Engineering Society
  - 5. NESC National Electrical Safety Code

1.5 SUBMITTALS

- A. Submit point to point photometric analysis of the entire job site to the property line. Utilize photometric data obtained from submitted fixtures only. Verify that all submitted fixture types and light levels are compliant with all local codes, ordinances, and the authority having jurisdiction. Submittal will not be reviewed by the A/E without this narrative data.
- B. Product Data: Provide dimensions, ratings, and performance data. Product data shall be submitted for all light fixtures showing:
  - 1. Dimensions

2. UL label
  3. Fusing
  4. Luminaire disconnect
  5. Metal gauge
  6. Lens thickness
  7. Finish
  8. Voltage
  9. Lamps
  10. Lightning arrestor, surge arrestor/, and/or surge protection device
- C. Submit drawings on concrete base complete with rebar, etc.
- 1.6 PROJECT RECORD DOCUMENTS
- A. Submit record documents to accurately record actual locations of each luminaire.
- 1.7 OPERATION AND MAINTENANCE DATA
- A. Submit Maintenance Data and include instructions for maintaining luminaires.
- 1.8 QUALIFICATIONS
- A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum five years experience.
- 1.9 REGULATORY REQUIREMENTS
- A. Furnish products listed and classified by Underwriters Laboratories as suitable for purpose specified and shown.
- 1.10 DELIVERY, STORAGE, AND HANDLING
- A. Deliver, store and protect products at site.
- B. Accept products on site. Inspect for damage.
- C. Protect poles from finish damage by handling carefully.
- D. Store and handle solid wood poles in accordance with ANSI O5.1.
- 1.11 COORDINATION
- A. Furnish bolt templates and pole mounting accessories to installer of pole foundations.
- PART 2 - PRODUCTS**
- 2.1 GENERAL
- A. All lighting fixtures mounted outdoors subject to dampness and insects shall have gasketing material between lens door and frame to completely seal interior of fixture. Knockouts and holes in fixtures housing shall be closed and sealed. All fixtures shall be complete with lamps, shielding, brackets, concrete bases, anchor bolts and all necessary fittings and accessories for a complete installation.
- B. Furnish products as specified on Drawings.
- C. All exterior light fixtures shall not have any labels exposed to normal viewing angles. This includes manufacturer labels and UL labels. All labels shall be concealed within the body of the fixture and/or luminaire. No manufacturer's name or logo shall appear on the exterior of any light fixtures unless accepted in writing by the Engineer.

- D. All light fixtures shall adhere to UL Test Standard #1598 and NEC 410.115(C). All manufacturers shall provide the required thermal protection as required.
- E. Pole luminaires, poles, and concrete bases shall comply with applicable requirements of IES, NESC, ASCE, FBC, and including but not limited to their requirements for illumination, uniformity, construction, wind loading, pole setback, breakaway, installation, glare criteria.
- F. All site lighting fixtures/luminaries that may spill light onto adjacent properties shall have glare control shield installed on all fixtures/luminaries as required to meet the glare control requirements of applicable codes and standards. Add required glare control shield to order/model number of all site lighting fixtures.

## 2.2 BALLASTS

- A. Fluorescent Ballast:
  - 1. Description: ANSI C82.1 electronic ballast rated for 0 degrees F.
  - 2. Provide ballast suitable for lamps specified.
  - 3. Voltage: Match luminaire voltage and voltage of system to which applied.
  - 4. Source Quality Control: Certify ballast design and construction by Certified Ballast Manufacturers, Inc.
  - 5. Ballast to be protected with in-line fuse/fuseholder.
  - 6. Provide disconnecting means for ballast that simultaneously disconnects all supply conductors to the ballast, including the ground conductor.
- B. High Intensity Discharge (HID) Ballast:
  - 1. Description: ANSI C82.4 lamp ballast to match lamp.
  - 2. Provide ballast suitable for lamp specified.
  - 3. Voltage: Match luminaire voltage and voltage of system to which applied.
  - 4. Ballast to be protected with in-line fuse/fuseholder.

## 2.3 LAMPS

- A. Provide lamp type specified for luminaire.
- B. All lamps shall match those specified in Section 16510 Interior Lighting Fixtures, Lamps and Ballasts.

## 2.4 LIGHTNING ARRESTER

- A. Provide lightning arrester for each pole light.
- B. Lightning arrester to be UL listed.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine excavation and concrete foundation for lighting poles.
- B. Examine each luminaire to determine suitability for lamps specified.

### 3.2 INSTALLATION

- A. Install all fixtures in accordance with manufacturers written instructions, NEC, IES, ASCE, FBC, and NESC.
- B. Install lighting poles at locations indicated.

- C. Install poles plumb. Provide double nuts to adjust plumb. Grout around each base.
- D. Install lamps in each luminaire.
- E. Bond luminaires, metal accessories and metal poles to branch circuit equipment grounding conductor. Provide supplementary grounding electrodes at each pole. See Section 16170 Grounding and Bonding.
- F. Where ceiling mounted fixtures are called for in the Light Fixture Schedule and on the drawings, this Contractor shall provide fixture trims and supports as required to match type of ceiling system which will be furnished. No ceiling fixtures shall be ordered until the Ceiling System Installer has given written acceptance of the method and location of fixture hanging and fixture type. Fixtures supported by suspended ceiling systems shall be securely fastened to the ceiling framing member by mechanical means, such as bolts, screws, or rivets. Clips identified for use with the type of ceiling framing member(s) and fixture(s) shall also be permitted.
- G. All exterior post/pole mounted light fixtures shall have hand hole near base. Hand hole shall provide easy access to light fixture fusing and lightning protection ground lug. Lightning protection ground lug shall be provided inside post/pole, electrically in contact with pole, for connection to ground rod. Provide and install ground wire from ground lug to ground rod, concealing ground wire through post/pole base. Anchor bolts to be galvanized.
- H. Pole installation shall comply with windloading criteria stated in ASCE 7-10 and Florida Building Code. Use V velocity = 130 Mph and the formulas and tables presented in ASCE 7-10.
- I. Provide soil compacting and/or treatment to assure windloading can be achieved for direct buried poles.
- J. Ducseal shall be installed to seal all conduits entering exterior light fixtures from underground.
- K. Lightning arrester and in-line fusing to be located at handhole location of pole for easy access.
- L. Verify all fluorescent fixtures have a luminaire disconnect. Provide luminaire disconnect in any luminaries where factory failed to install luminaire disconnect

### 3.3 FIELD QUALITY CONTROL

- A. Operate each luminaire after installation and connection. Inspect for improper connections and operation.

### 3.4 ADJUSTING

- A. Aim and adjust luminaires to provide illumination levels and distribution as directed.
- B. Re-lamp luminaires which have failed lamps at Date of Substantial Completion.

### 3.5 GLARE CONTROL

- A. Provide, install and adjust glare control shields to prevent light glare on adjacent properties.

### 3.6 CLEANING

- A. Clean electrical parts to remove conductive and deleterious materials.
- B. Remove dirt and debris from enclosure.
- C. Clean photometric control surfaces as recommended by manufacturer.
- D. Clean finishes and touch up damage.
- E. Luminaires:
  - 1. Clean free from dust and dirt. Wash lens and glassware using cleaner such as Windex and dry with absorbent paper. Clean plastic per manufacturer's recommendations; do not wipe. Lenses which are kept in original containers until immediately prior to final inspection

may not require cleaning. Clean Alzak aluminum surfaces (reflectors, fixture cones and the like) per manufacturer's recommendations being careful to remove fingerprints and smudges.

2. It is the Contractor's responsibility to remove any UL labels or manufacturer's labels from areas of fixture exposed to view and relocate label to non-obtrusive area on fixture.

END OF SECTION



SECTION 16535 - EMERGENCY LIGHTING 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. Emergency lighting units.
  - 2. Emergency exit signs.
  - 3. Emergency fluorescent lamp power supplies.

1.3 REFERENCES

- A. Americans with Disabilities Act (ADA)
- B. ANSI C78.379 Classification of the Beam Patterns of Reflector Lamps
- C. ANSI C82.1 Lamp Ballast – Line Frequency Fluorescent Lamp Ballast
- D. ANSI/NFPA 70 National Electrical Code
- E. Florida Building Code (FBC)
- F. Fed. Spec. W-L-305D Light Set, General Illumination (Emergency or Auxiliary)
- G. NFPA 101 Life Safety Code
- H. NEMA WD 1 General Requirements for Wiring Devices

1.4 REGULATORY REQUIREMENTS

- A. Conform to requirements of the following:
  - 1. ADA
  - 2. ANSI/NFPA 70
  - 3. FBC
  - 4. NFPA 101
- B. Furnish products listed and classified by Underwriters Laboratories as suitable for purpose specified and shown.

1.5 DESCRIPTION

- A. Light fixtures furnished under this Division shall be furnished complete with lamps and all necessary trim and mounting hardware, and installed as shown on the Drawings.
- B. Light fixtures shall be neatly and firmly mounted, using standard supports for outlets and fixtures.
- C. Lamps shall be included in the system guarantee for a period of thirty days after final acceptance of the building.

1.6 SUBMITTALS

- A. Shop Drawings: Indicate dimensions and components for each luminaire that is not a standard product of the manufacturer.
  - 1. Shop drawings shall be submitted for all fixtures that require modifications, either as specified or as required to fit architectural field conditions of this project; (i.e., specialty exit

signs).

2. Shop drawings shall be complete showing all dimensions and installation instructions required for conditions on this project.
- B. Product Data: Provide dimensions, ratings, and performance data. Product data shall be submitted for all fixtures showing:
1. Dimensions
  2. UL label
  3. Fusing
  4. Metal gauge
  5. Lens/louver thickness
  6. Finish
  7. Voltage
  8. Lamps
  9. Batteries
- 1.7 OPERATION AND MAINTENANCE DATA
- A. Submit maintenance data including replacement parts list.
- 1.8 MANUFACTURER'S QUALIFICATIONS
- A. Company specializing in manufacturing products specified in this Section with minimum five years experience.
- 1.9 PRODUCT STORAGE AND HANDLING
- A. Physically protect fixtures against damage as recommended by manufacturer.
- 1.10 MAINTENANCE MATERIALS
- A. Provide to Owner:
1. Ten of each size/type of fuses.
  2. Six of each type of lamps.
- 1.11 WARRANTY
- A. All ballasts furnished under this Division shall be covered by a warranty against defects. Warranty shall include payment for normal labor costs of replacement of inoperative in-warranty ballasts.

## PART 2 - PRODUCTS

### 2.1 LUMINAIRES/FIXTURES

- A. Furnish products as specified in schedule on Drawings.
- B. Install ballasts, lamps, and specified accessories at factory.
- C. All light fixtures shall adhere to UL Test Standard 1598, UL 924 and NEC 410.115(C). All manufacturers shall provide the required thermal protection as required.

### 2.2 SELF-CONTAINED EMERGENCY POWER EXIT SIGNS

- A. Type: Exit signs with integral battery-operated emergency power supply including power failure relay, test switch, AC ON pilot light, battery, and fully-automatic two-rate charger.

- B. Battery: Sealed nickel cadmium cell, requiring no maintenance or replacement for ten years under normal conditions. Batteries to have a nine year warranty, and provide for ninety minute capacity.
- C. Exit sign fixture shall be suitable for use as emergency lighting unit.
- D. Exit sign shall be die-cast with universal mount, universal arrows, down light, stencil face. Arrows shall be as shown on Drawings.
- E. Exit signs to have long life LED lamps for normal and emergency operation, integral battery; battery charger, transformer, test switch, and LED charge monitor light.
- F. Transformer shall be dual rated for 120 or 277 volts.
- G. Furnish all lamps required.
- H. Charger shall comply with UL 924.

### 2.3 INCANDESCENT EMERGENCY LIGHTING UNITS

- A. Description: Self-contained emergency lighting unit.
- B. Battery: 6 volt nickel cadmium type with 1.5 hour capacity.
- C. Battery Charger: Dual-rate type with sufficient capacity to recharge discharged battery to full charge within twelve hours.
- D. Lamps: 9 watt minimum.
- E. Remote Lamps: Match lamps on unit.
- F. Housing: As called for on Drawings.
- G. Indicators: Provide lamps to indicate AC ON and RECHARGING.
- H. Provide TEST switch to transfer unit from external power supply to integral battery supply.
- I. Electrical Connection: Conduit connection.
- J. Input Voltage: To match applied circuit voltage.

### 2.4 FLUORESCENT LAMP EMERGENCY POWER SUPPLY

- A. Manufacturers:
  - 1. Bodine Model B50 Series
  - 2. Chloride Model CFP60 Series
  - 3. Prescolite Model EFP5 Series
  - 4. Lithonia PS1100 Series
  - 5. Lightolier FBP50
- B. Description: Emergency battery power supply suitable for installation in ballast compartment of fluorescent luminaire.
- C. Lamp Ratings: One or two FO32 T8 lamps providing a total of 900-1100 lumens for 90 minutes minimum.
- D. Battery: Sealed nickel cadmium type, rated for seven year life.
- E. Include TEST switch and AC ON indicator light, installed to be operable and visible from the outside of an assembled luminaire.
- F. Inverter/charger unit shall be completely solid state with automatic transfer in case of power failure and automatic cutout to prevent deep discharge of batteries. Recharge time shall be

twenty-four hours maximum.

- G. Units to be installed in fixtures utilizing energy saving lamps and/or ballast shall be a type compatible for use with this equipment.
- H. Connect unit to local lighting circuit ahead of all switches. Provide and install wiring to accomplish this.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. Install units plumb and level.
- B. Aim directional lampheads as directed.
- C. Adjust units as required to align with building lines and with each other. Secure to prohibit movement.
- D. Adjust exit sign directional arrows as indicated. Readjust at project completion as required by Authority Having Jurisdiction.
- E. Install illuminated exit signs as shown on Drawings, as herein specified, or as required by applicable codes.
- F. Connect exit signs, inverter/battery units to local lighting circuit ahead of all switches.
- G. Install suspended exit signs using pendants supported from swivel hangers.
- H. Mount all exit signs at 7'-6" AFF to bottom of fixture or as required to meet ADA requirements. Provide all mounting accessories/hardware as required for proper mounting including pendant/swivel hangers.
- I. Evenly space all emergency egress lighting units and provide proper lumen output of units as required to provide lighting levels and uniformity ratios required by applicable codes.
  - 1. FBC Section 1006.2.3.1 Emergency lighting facilities shall be arranged to provide initial illumination that is at least an average of 1 footcandle and a minimum at any point of 0.1 footcandle measured along the path of egress at floor level. Illumination levels shall be permitted to decline to 0.6 footcandle average and a minimum at any point of 0.06 footcandle at the end of the emergency lighting time duration. A maximum-to-minimum illumination uniformity ratio of 40:1 shall not be exceeded.

END OF SECTION

## SECTION 16621 - STANDBY EMERGENCY GENERATOR - RADIATOR COOLED ENGINE

## 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.
- B. Section 16491 – Automatic transfer switches.

## 1.2 GENERAL PROVISIONS

- A. It is the intent of these Specifications to secure for the purchaser, a diesel engine driven generator set of the latest commercial type and design as specified herein. All material and equipment shall be new and undamaged. Generator system shall meet or exceed the national emission standards for hazardous air pollutants for reciprocating internal combustion engines as defined by the Environmental Protection Agency. System with all components must meet or exceed requirements of NFPA 110 for Level 1 loads, UL 2200 Stationary Engine Generator Assemblies and UL 1004 Electric Motors.
- B. It is essential that the engine-generator supplier maintain a local parts and service facility. Local shall be defined as having a 2 hour response time to project site. The supplier shall furnish the complete installation and provide test supervision necessary for final acceptance. The generator set supplier shall furnish and install all equipment except underground fuel storage tanks and underground fuel piping. All power feeders and service entrance conductors and conduit shall be furnished and completely installed by Electrical Contractor. All generator control alarm and interlock wiring including conduit shall be completely furnished and installed by generator set supplier.
- C. Warranty: Equipment furnished under this Section shall be guaranteed against defective parts or workmanship under terms of the manufacturer's and dealer's standard warranty. In no event shall it be for a period of less than 5 years from date of substantial completion of the system.
- D. For system coordination, startup and single source service responsibility, the automatic transfer switches shall be provided by the generator set supplier. The transfer switch manufacturer shall be as specified in Section 16491 Automatic Transfer Switch. Installation drawings and job site installation recommendations shall be provided for use by the installing contractor. System operation and maintenance manuals (three complete sets) for the generator set accessories and automatic transfer switches shall be provided by the system supplier. A minimum of four hours of operating and maintenance instruction for the system shall be provided after startup and testing.

## 1.3 EXPERIENCE

- A. The units must be manufactured in the USA and shall be the product of a firm regularly engaged in the manufacture of engine generator sets for a period of not less than 5 years and shall meet the requirements of Specifications set forth herein. It must be a standard model in regular production at the manufacturer's place of business. Engine, generator and control panels are to be serviced by the same supplier so that there shall be one source and one responsibility.
- B. This supplier shall have had experience with five or more installations of systems of comparable size and complexity in regards to coordinating, engineering, testing and supervising. Experience shall be with jails and prisons within the state of Florida. Orange County Government and Matern Professional Engineering retains the right to inspect any of these installations and operations of the engine-generator set and question the user concerning the installations without the presence of the supplier.
- C. The generator supplier shall meet the following minimum qualifications:
  - 1. Authorized distributor and warranty service center for the engine, alternator, and automatic transfer switch. The use of a third party authorized distributor or third party service provider for the engine, alternator or automatic transfer switch by the generator supplier is not acceptable.
  - 2. Generator supplier shall have been in the business of selling and servicing engines, generators, and automatic transfer switches for a period of not less than 10 years.
  - 3. Permanent supplier owned service facility located with 50 miles of the project site that stocks parts for the engine, generator, and automatic transfer switch.

4. Five projects of similar scope and complexity completed in the last five years that are within 100 miles of project site. The Engineer must have the ability to observe any of these installations and question the user concerning the installation without the presence of the Supplier.
5. Five installations of similar scope and complexity located within 100 miles of project site that have been in service for not less than 10 years. The Engineer must have the ability to observe any of these installations and question the user concerning the installation without the presence of the Supplier.
6. Not less than three service technicians with 10 or more years experience that live within 75 miles of the project site.

#### 1.4 SHOP DRAWINGS AND PRODUCT DATA

- A. Submit shop drawings and product data on the following showing compliance with the specifications:
  1. Generator/Engine.
  2. Exhaust muffler.
  3. All components to meet EPA requirements for Stand-by generators including but not limited to a run time meter, and additional catalytic converters.
  4. Flexible exhaust piping.
  5. Base and spring vibration isolators.
  6. 24 Hour Base fuel tank.
  7. Control panel.
  8. Unit mounted annunciator panel.
  9. Remote annunciator panel.
  10. Main line circuit breaker.
  11. Copy of service contract.
  12. Weatherproof housing.
  13. Batteries and rack.
  14. Battery charger.
  15. Crankcase Heater.
  16. Interior Housing Lighting System.
  17. Complete load data sheet showing compliance with specified ratings.
  18. UL listing information including all UL Card, UL Card information, and must be verifiable at [www.ul.com](http://www.ul.com)
- B. Submittals shall clearly indicate:
  1. Dimensions of unit complete with radiator, generator, engine, base, housing, etc.
  2. All pertinent data/ratings as required to show equipment meets specifications.
  3. Amperage of main line breakers and their interrupting capacity.
  4. Dimensions, etc. of exhaust muffler, piping, base, isolator, day tank, control panel, annunciator panel batteries, rack, charger, etc.
  5. Weatherproof housing with location of batteries and day tank.
  6. Arrangement of air intakes and air exhausts. Indicate minimum distance to obstructions such as walls, etc.
  7. Dimensioned site survey showing proposed location, size, and construction of concrete pads for both generator and fuel tank. All items shall be coordinated with all disciplines prior to rough in.
  8. Generator provider shall provide generator pad and fuel tank details, for the generator being provided. Details shall include rough in locations, concrete rating, rebar size and location, etc.
- C. Supplier qualifications submittal information shall include:
  1. Letter from engine generator manufacture that they are the authorized distributor and warranty service center for the engine, alternator and automatic transfer switch being supplied for the project. Letter shall identify how many years that they have been the authorized distributor and warranty service center.
  2. Current business licenses and past business licenses going back for a period of not less

- than 5 years indicating that Supplier was involved in the sales and service of engine/generators and associated equipment.
3. Map from MapQuest or Google Earth identifying the location of the service center, project site and distance between the two.
  4. Submit documentation including site contact information for five installations of similar scope and complexity located within 200 miles of project site that have been in service for not less than 10 years.
    - a) Narrative description of facility and equipment.
    - b) Date of installation.
    - c) Contact information for facility.
    - d) Ratings of engine, alternator, and automatic transfer switch
    - e) Specific model/manufacturer information for engine, alternator, and automatic transfer switch.
    - f) Photographs of Engine/Generator Set, engine, alternator, and automatic transfer switch.
  5. Resumes of local staff that will be responsible for serving the installation. Resumes shall include:
    - a) Areas of expertise
    - b) Employment history
    - c) Similar project experience
    - d) Certifications
    - e) City of Residence
    - f) Distance between place of residence and project site

## PART 2 - MATERIALS/PRODUCTS/INSTALLATION

### 2.1 GENERATING SYSTEM

- A. The effective site rating of the electric power generating system shall be as noted on Drawings.
- B. The above ratings shall be based on site conditions as follows:
  1. Generator shall be used for standby emergency service to provide continuous electrical service during interruption of normal power.
  2. Generator installation as shown on Drawings.
  3. Altitude of less than 200' above sea level.
  4. Maximum ambient temperature of 100 percent F.
  5. Minimum ambient temperature of 20 percent F.
- C. Ratings of the diesel electric set shall be based on operation of the unit at rated generator RPM, when supplied with all necessary operating accessories such as radiator fan, the air cleaners, lubricating oil pump, fuel transfer pump, fuel injection pumps, jacket water pump, alternating current generator, exciter, and other accessories necessary to the unit.
- D. Diesel engines shall be able to deliver rated power when operating on No. 2 diesel fuel having 35° API (16°C or 60°) specific gravity.
- E. Fuel consumption rates shall be based on fuel having a low heating value (LHV) of 42,780 kJ/kg (18,390 Btu/lb) when used at 29° (85°F) and weighing 838.9 g/l (7.001 lbs/US). The maximum fuel consumption shall be:

Percent load	100	75	50
Fuel consumption	<u>19.4</u>	<u>15.5</u>	<u>11.6</u>
(GPH)			
- F. Motor Starting - Motor starting inrush of 312 kVA shall result in maximum instantaneous voltage dip not greater than 15 percent measured by light beam oscillograph.
- G. Sound Level - Mechanical sound level where all generator sets are fully loaded shall be not greater than 80 dBA at 23' (7 m).
- H. Start Time and Load Acceptance - Engines shall start, achieve rated voltage and frequency, and be capable of accepting load within ten seconds when properly equipped and maintained.
- I. Block Load Acceptance - Transient response shall conform to ISO 8528 requirements.

- J. The complete unit shall be equipped with special SCR filters or PMG (permanent magnet generator) to allow UPS systems and elevator systems to be connected to emergency system with no effect on emergency system performance.
- 2.2 ENGINE
- A. The diesel engine shall be watercooled 4-cycle compression ignition diesel turbo-charged for maximum efficiency. Engine speed shall not exceed 1800 RPM. No dual speed or multi-speed engines will be considered.
- B. The engine shall be equipped with air filters, fuel filters, fuel pressure gauge, lubricating oil cooler, filters, oil pressure gauge, water pump, temperature gauge, service hour meter, flywheel, and flywheel housing.
- 2.3 DUTY CYCLE
- A. The engine shall be capable of operation at light loads for extended periods of time and shall provide for precombustion of fuel or a similar means for the prevention of carbonization.
- 2.4 GOVERNOR
- A. The engine governor shall be an electronic speed control with 24 volt dc electric actuator. speed droop shall be 0 (isochronous) from no load to full rated load. Steady state frequency regulation shall be  $\pm 0.25$  percent. Speed shall be sensed by a magnetic pickup off the engine flywheel ring gear. A provision for remote speed adjustment shall be included.
- 2.5 COOLING SYSTEM - RADIATOR
- A. The engine jacket water cooling system shall be a closed circuit design with provision for filling, expansion, and deaeration. The cooling pump shall be driven by the engine. Coolant temperature shall be internally regulated to disconnect cooling systems until operating temperature is achieved.
- B. Heat rejected to the engine jacket water shall be discharged to the atmosphere through a close coupled engine mounted radiator. The radiator shall be sized to cool the engine continuously while operating at full rated load and at site conditions.
- C. The fan, fan drive, and fan belts shall be covered with 14 gauge punched steel mesh guarding for personnel protection. The guarding shall conform to IEC 34-5, ISO and OSHA standards.
- 2.6 HEATER AND ANTIFREEZE
- A. The engines shall be provided with antifreeze (a solution of 25 percent ethylene glycol) and suitable unit mounted thermal circulation type water heaters incorporating a thermostatic switch to maintain engine jacket water to 90°F in an ambient temperature of 30°. The heaters shall be sized as recommended by manufacturer, single phase, 60 hertz, voltage to match that shown on drawings. Heaters shall be Kim-Hotstart, Chromalox or accepted substitution.
- 2.7 LUBRICATION SYSTEM
- A. The lubrication oil pump shall be a positive displacement type that is integral with the engine and gear driven from the engine gear train. The system shall incorporate full flow filtration with bypass valve to continue lubrication in the event of filter clogging.
- B. The bypass valve must be integral with the engine filter base or receptacle. Systems where bypass valves are located in the replaceable oil filter are not acceptable.
- C. System shall include a filter strainer, thermostatic control valve and crankcase drain.
- 2.8 FUEL SYSTEM
- A. Injection pumps and injection valves shall not require adjustment in service. The engine shall have an individual mechanical injection pump and injection valve for each cylinder, any one of which may be removed and replaced from parts stock.
- B. Fuel injection pumps shall be positive action, constant-stroke pumps, actuated by a cam driven by gears from the engine crankshaft. Fuel lines between injection pumps and valves shall be heavy seamless tubing, and to eliminate irregularity of fuel injections, shall be of the same length for all cylinders.
- C. Fuel system shall be equipped with replaceable fuel filter elements which may be easily removed without breaking any fuel line connections or disturbing the fuel pumps or any other parts of the engine.
- D. All fuel filters shall be conveniently located in one accessible housing, ahead of injection pumps so that fuel will have been thoroughly filtered before it reaches the pumps. No screens or filters



- requiring cleaning or replacement shall be used in injection pump or injection valve assemblies.
- E. Engine shall be equipped with a built-in gear-type engine-driven fuel transfer pump, capable of lifting fuel against a head of twelve feet, for supplying fuel through the filters to the injection pump at constant pressure.
- F. In addition to the standard filter, the fuel system shall include a primary fuel filter between the fuel tank and transfer pump to screen large contaminants.
- G. A fuel/water separator shall protect the fuel system from water damage. Separator shall be installed such that it is easily accessible to service personnel.
- H. Tanks. Provide complete with all piping, etc.:
1. Primary tank shall be a insulated secondary containment above ground storage tank for combustible liquids listed for UL-142 and UL-2085. Primary tank shall be of concrete, and must be on current approve EPD list.
  2. Fuel tank shall be provided with lightning protection per NFPA 780 standards and be part of the UL master label for the facility.
  3. All aboveground fuel tanks shall be, double-walled, and consist of main fuel storage tank with float switch and fuel level indication shall be furnished and installed by the CONTRACTOR. **All tanks shall meet FDEP regulations and have an on-site, approved FDEP Inspection Report completed and provided to County prior to fueling the aboveground storage tank or pump station startup.**
  4. All storage tank systems installations, removals and upgrades shall meet all current and proposed FDEP and FAC rules and regulations. All equipment utilized as apart of a fuel system installation or upgrade shall meet the most current FDEP approved equipment list as provided on the FDEP website (Storage Tank Regulation). CONTRACTOR shall be responsible to permit the fuel tank through FDEP prior to fueling, start-up and acceptance by the COUNTY.
  5. 3. All aboveground
  6. Day Tank shall be skid mounted integral to the unit and enclosure. Day Tank shall be constructed of a minimum 10 gauge ASTM A36 Mild steel. The day tank shall be equipped with three pumps: Two 4 GPM supply pumps and one 7 GPM return pump (adequately sized to keep up with minimum two times the engine transfer pump maximum flow rate). Pumps shall be coupled to an adequately sized, totally enclosed fan-cooled electric motor. The motors shall be installed on the tank top and factory wired to pump control panel or motor starters if required. Supply pumps shall arrive on-site with pressure side pre-plumbed to the day tank supply connections. Suction side shall be connected with field piping by the responsible contractor. Supply pumps shall be shipped with a check valve installed on the pressure side. One normally-closed solenoid valve shall be installed on the suction side of each supply pump. These valves shall be factory-wired to the pump control panel. The return pump shall arrive on site with suction side pre-plumbed to a tank fitting with suction tube. Discharge side of the pump shall be connected with field piping by the responsible contractor. A leak sensor probe assembly shall be provided in order to detect liquid in the tank interstitial space. The leak sensor shall be wired to the pump control panel. A visual mechanical leak detection gauge shall also be provided. The primary vent assembly shall be shipped loose, for installation by the mechanical contractor. An emergency vent shall be provided for the primary and secondary tanks, including a pressure-activated vent cap on each vent fitting.
  7. Size of tank shall be the larger of the following (submit calculations based on proposed generator provider):  
Primary tank:
    - a) Size as required by NFPA 110.
    - b) 500 Gallons based 24 hours of full load operation.Day tank:
    - a) Size as required by NFPA 110.
    - b) Sized for 3 hours of full load operation.

8. Annunciation. Provide low-level annunciation as required by NFPA 110.
9. All generator fuel tanks shall be installed by a Florida Certified Pollutant Storage Contractor. Installer shall obtain required permits for the installation of the fuel tank. Installer shall meet all applicable codes for the installation of fuel tanks and shall provide all required containment/monitor systems
10. Provide and install complete electric solenoid fuel shut-off valve with connections, etc., with control switch. Locate switch near building shunt-trip switches, and label "Generator Fuel Shut-Off".

## 2.9 STARTING

- A. Starting Motor: A dc electric starting system with positive engagement drive shall be furnished. The motor voltage shall be as recommended by the engine manufacturer.
- B. Automatic Control: Fully automatic generator set start stop controls in the generator control panel shall be provided. Controls shall provide shutdown for low oil pressure, high water temperature, overspeed, overcrank, and two auxiliary contacts for activating accessory items. Controls shall include a 30 second single cranking cycle limit with lockout.
- C. Batteries: A nickel-cadmium storage battery to be used in conjunction with the electric starting system shall be provided. The battery shall be rated by the battery manufacturer in accordance with requirements set forth by the engine manufacturer. A battery rack and necessary cables and clamps shall be provided. Batteries shall be mounted as shown. Wiring shall be sized as required by manufacturer for distance involved.
- D. Battery Charger: Current limiting battery charger shall be furnished to automatically recharge batteries. Charger shall float at 1.4 volts per cell and equalize at 1.6 volts per cell. It shall include overload protection, silicon diode full wave rectifiers, voltage surge suppressor, dc ammeter, dc voltmeter and fused ac input. AC input voltage shall be 120 volts, single phase. Amperage output shall be no less than 6 amperes. Charger shall be Lamarche A46 or equal. Charger shall have an auxiliary contact to close on charger failure. Provide and install two #12, 1/2" C. from contact to remote annunciator.

## 2.10 GENERATOR

- A. The generator shall be a 3-phase, 60 hertz, single bearing, rotating field, synchronous, brushless type built to NEMA Standards. A voltage regulator shall be provided to match the characteristics of the generator and engine. Voltage regulation shall be +/- 2 percent from no load to full rated load. Readily accessible voltage drop, voltage level and voltage gain controls shall be provided. Voltage level adjustment shall be a minimum of +/- 5 percent. Generator and exciter shall be inherently capable of parallel operation with other power sources of equivalent electrical characteristics.

## 2.11 MAIN LINE CIRCUIT BREAKER(S)

- A. A mainline molded case circuit breaker(s) sized to the output of the generator shall be installed as a load circuit interrupting and protective device. It shall operate both manually for normal switching function and automatically during overload and short circuit conditions. Breaker(s) shall be mounted on generator terminal box.
- B. The trip unit for each pole shall have elements providing inverse time delay during overload conditions and instantaneous magnetic tripping for short circuit protection. The circuit breaker shall meet standards established by Underwriters Laboratories, National Electric Manufacturers Association, and National Electrical Code.
- C. Generator exciter field circuit breakers do not meet the above electrical standards and are unacceptable for line protection.
- D. Provide and install multiple circuit breakers called for on drawings at the generator terminals. Each breaker shall be isolated/separated into different/separate enclosure compartments. Each breaker shall have shunt trip function operated by remote shunt trip button called for elsewhere in these specifications.
- E. Provide and install isolated/separate enclosure compartments as required to separate low voltage circuits and terminations from 120, 208, 277 and 480 volt circuits/terminations.

## 2.12 EXHAUST AND MUFFLER

- A. A critical exhaust silencer shall be provided in accordance to the engine manufacturer's recommendations for silencing. The silencer shall provide extreme noise attenuation for environments with low background noise and slight noise emissions would be objectionable.
  - B. A flexible stainless steel exhaust adapter, 12" minimum length should be furnished for mounting between the engine and exhaust piping. The muffler will be of side (or end) inlet design for horizontal mounting with flange(s) for connection to exhaust pipe(s) provided by Division 22 Contractor. Mount the silencer above the generator horizontally, pitch silencer away from engine and make provisions for draining moisture. Provide and install insulation (calcium silicate) complete on silencer.
- 2.13 BASE AND ISOLATORS
- A. The engine-generator shall be mounted on a welded steel base with spring type vibration isolators which will effectively isolate engine vibration from the foundation. A reinforced concrete base shall be provided as specified by the manufacturer. Rubber pad type isolator will be acceptable for outdoor installations only .
- 2.14 OUTDOOR WEATHER-PROTECTIVE SOUND ATTENUATING HOUSING
- A. The generator set shall be provided with a sound-attenuated housing which allows the generator set to operate at full rated load in the ambient conditions previously specified. The enclosure shall reduce the sound level of the generator set while operating at full rated load to a maximum of 80 dBA at any location 7 meters from the generator set in a free field environment. Housing configuration and materials used may be of any suitable design which meets application needs, except that acoustical materials used shall be oil and water resistant. No foam materials shall be used unless they can be demonstrated to have the same durability and life as fiberglass.
  - B. The enclosure shall include hinged doors for access to both sides of the engine and alternator, and the control equipment. Key-locking and padlockable door latches shall be provided for all doors. Door hinges shall be stainless steel.
  - C. The enclosure shall be provided with an exhaust silencer which is mounted inside of the enclosure, and allows the generator set package to meet specified sound level requirements. Silencer and exhaust shall include a raincap and rainshield.
  - D. All sheet metal shall be primed for corrosion protection and finish painted with the manufacturers standard color. All surfaces of all metal parts shall be primed and painted.
  - E. Painting of hoses, clamps, wiring harnesses, and other non-metallic service parts shall not be acceptable. Fasteners used shall be corrosion resistant, and designed to minimize marring of the painted surface when removed for normal installation or service work.
  - F. Enclosure shall be complete with all required accessories such as exhaust mounting brackets, exhaust hole dress cap and radiator access cover, etc.
  - G. Enclosure shall be sized as required to house all accessories such as batteries, battery charger, day tank, suction pumps, etc.
  - H. Enclosure shall be of same manufacturer as Generator Set.
- 2.15 GENERATOR CONTROL PANEL (AND CONTROLS)
- A. A generator mounted NEMA 1 type vibration isolated 14 gauge steel control panel shall be provided to meet requirements of NFPA 110 for Level 1 systems.
  - B. Equipment - Panel shall contain, but not be limited to the following equipment:
    - 1. Voltmeter, 1 percent accuracy (digital type)
    - 2. Ammeter, 1 percent accuracy (digital type)
    - 3. Ammeter-Voltmeter phase selector switch
    - 4. Non Resettable hour meter.
    - 5. (Remote) Automatic starting controls as specified (with remote control)
    - 6. Voltage level adjustment rheostat (+/-5 percent voltage adjustment)
    - 7. Frequency meter, 1 percent accuracy (digital type)
    - 8. Dry contacts for remote alarms wire to terminal strips
    - 9. Three position function switch marked "run" "off" "auto"
    - 10. Equipment for shutdown required by NFPA 110:
      - a) Overcrank

- b) High engine temperature
  - c) Low lube oil pressure
  - d) Overspeed
  - e) Remote emergency stop
11. Equipment for Alarms required by NFPA 110:
- a) Control Panel Unit Mounted Visual Indication:
    - 1. overcrank
    - 2. low water temp. less than 70°F (21°C)
    - 3. high engine temperature prealarm
    - 4. high engine temperature:
      - (a) low lube oil pressure prealarm
      - (b) low lube oil pressure
      - (c) overspeed
      - (d) low fuel main tank
      - (e) EPS supplying load
      - (f) control switch not in auto. position
      - (g) battery charger malfunctioning
      - (h) low voltage in battery
      - (i) lamp test
      - (j) contacts for local and remote common alarm
      - (k) low starting air pressure
      - (l) low starting hydraulic pressure
      - (m) air shutdown damper when used
  - b) Remote Audible:
    - 1. overcrank
    - 2. low water temp. less than 70°F (21°C)
    - 3. high engine temperature prealarm
    - 4. high engine temperature
      - (a) low lube oil pressure prealarm
      - (b) low lube oil pressure
      - (c) overspeed
      - (d) low fuel main tank
      - (e) control switch not in auto. position
      - (f) contacts for local and remote switch
      - (g) air shutdown damper when used
12. Equipment for Controls required by NFPA 110:
- a) Manual Emergency Shutdown
- C. Any additional safeties as recommended by the manufacturer or as required by applicable codes shall be provided. A mechanical overspeed system shall back up to the electric overspeed. Auxiliary relays and or contacts shall be provided to operate a remote annunciator panel as shown on drawings.
- D. Provide all lock-out functions required by NFPA 110.
- 2.16 ANNUNCIATION PANEL
- A. A panel shall be provided for remote mounting as shown to give audible and visual warning of fault or alarm conditions in the generator set, battery charger and levelometer. The panel shall conform with the requirements of NEC 700.7 and NFPA 110. Panel shall be flush mounted at location shown in Drawings. Where no location is shown, locate per NFPA 110 and Authority Having Jurisdiction. Simplex model or accepted substitution.
  - B. Annunciator shall be powered by generator battery and:
    - 1. Have individual visual signals for:
      - b) When the emergency generator set is operating to supply power to load.
      - c) When the battery charger is malfunctioning.
    - 2. Have individual visual signals plus common audible signal for:
      - d) Low lubricating oil pressure.

- e) Low water temperature.
  - f) Excessive water temperature.
  - g) Low main tank fuel level (less than three-hour supply).
  - h) Overcrank.
  - i) Overspeed.
- C. Provide and install all wiring and conduit to generator control panel, battery charger, and levelometer as required to perform the above annunciation.
- 2.17 REMOTE MANUAL STOP STATION
- A. Provide, install, and connect a remote manual stop station of a type similar to a break-glass station located outside the room housing the prime mover (when so installed) or elsewhere on the premises when the prime mover is located outside the building.
  - B. Locate at location acceptable to Authority Having Jurisdiction.
- 2.18 SYSTEM SERVICE CONTRACT
- A. The supplier of the standby power system must provide a copy of and make available to the Owner his standard service contract which, at the Owner's option may be accepted or refused. This contract will accompany any documents, drawings, catalog cuts, specifications sheet, wiring or outline drawings, etc. submitted for acceptance to the Engineer.
- 2.19 ACCEPTABLE MANUFACTURERS
- A. Caterpillar as provided by Ringhaver Equipment
  - B. Cummins as provided by Cummins Southeastern Power
  - C. Detroit Diesel as provided by Florida Detroit Diesel
  - D. Generac as provided by Zabatt

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. The emergency generator shall be installed as shown on the Drawings, in accordance with the manufacturer's recommendations and all applicable codes. Provide all associated control wiring to generator, annunciator, transfer switches, etc. as required.
- B. Provide all interface control wiring and conduit as required to provide complete emergency operation of equipment on project.

#### 3.2 SITE TEST

- A. See Section 16491 Automatic Transfer Switches.

#### 3.3 LOAD BANK TEST

- A. After the building load test, a load bank test will be performed. This test shall be done with resistive dry load banks, in the presence of the Engineer and Owner. Test shall be performed during regular business hours and days only - Monday - Friday, 8:00 A.M. to 5:00 P.M.
  - 1. 1 hour 50 percent
  - 2. 1 hour 75 percent
  - 3. 3 hours 100 percent
  - 4. 10 minutes cooldown
- B. During test, a written log shall be maintained at 15-minute intervals with the following:
  - 1. Ambient Air Temperature
  - 2. Power quality including but not limited to: Voltage, frequency, harmonic content, and power factor.
  - 3. Oil Pressure
  - 4. Water Temperature
  - 5. Battery Charging
  - 6. Exhaust Stack Temperature, emission output, exhaust back pressure.
  - 7. Noise Level in dba (each side)
  - 8. Fuel for load test to be included in bid

#### 3.4 FUEL TANK INSTALLATION

- A. Install fuel tanks as required by all applicable codes, regulations, authorities, etc.

#### 3.5 ANNUNCIATION

- A. Install remote annunciator complete with all wiring/conduit in location per NFPA 110 and local

Authority Having Jurisdiction.

3.6 WARRANTY

- A. The generator set and associated equipment shall be warranted for a period of not less than five years from the date of substantial completion against defects in materials and workmanship. The warranty shall be comprehensive. No deductibles shall be allowed for travel time, service hours, repair parts cost, etc.

3.7 TRAINING/DEMOS TRATION

- A. A factory authorized service representation shall train owner's maintenance personnel and staff to adjust, operate, and maintain packaged generator set, ATS, fuel tanks, and other peripheral equipment.

END OF SECTION 16621

## SECTION 16671 - LIGHTNING PROTECTION SYSTEM

### PART 1 – GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section includes:
  - 1. Air terminals and interconnecting conductors.
  - 2. Grounding and bonding for lightning protection.
- B. A Lightning Protection System shall be provided and installed on the structure(s) even though not shown on Drawings, by experienced installers in compliance with provisions of code for Lightning Protection Systems as adopted by the National Fire Protection Association and Underwriters Laboratories. All equipment to that result shall be included whether or not specifically called for herein with the additional requirement that the system shall meet all the requirements of LPI.
- C. Bond/ground all building mounted and/or grade mounted antennae and satellite systems/dishes.
- D. Provide complete lightning protection system for all pavilions and/or structures, including but not limited to all shelters and play ground pavilions.
- E. Materials shall comply in weight, size and composition with the requirements of Underwriters Laboratories and the National Fire Protection Code relating to this type of installation, and shall be UL labeled.
- F. All materials, where available by any one manufacturer, shall be cast.

#### 1.3 REFERENCES

- A. ANSI/NFPA 780 Standard for the Installation of Lightning Protection Systems
- B. ANSI/UL 96 Lightning Protection Components
- C. UL 96A Installation Requirements for Lightning Protection Systems
- D. LPI Lightning Protection Institute
- E. OSHA Standard 29 CFR
- F. Section 16090 Tests and Performance Verification
- G. Section 16170 Grounding and Bonding

#### 1.4 REGULATORY REQUIREMENTS

- A. System shall comply with the following:
  - 1. ANSI/NFPA 780 Class II
  - 2. UL 96A Master Label for:
    - a) New installation, and
    - b) Reconditioned installation UL 96A; Letter of Findings.

#### 1.6 SUBMITTALS

- A. Submit shop drawings showing layout of air terminals, grounding electrodes, and bonding

connections to structure and other metal objects. Include terminal, electrode, and conductor sizes, and connection and termination details. Drawings shall include full layout of cabling and points, and connections.

- B. Submit product data showing dimensions and materials of each component, and include indication of listing in accordance with ANSI/UL 96.
- C. Submit manufacturer's installation instructions.
- D. Submittal shall include ground wells as called for in Section 16170 Grounding and Bonding.
- E. Shop drawings shall be submitted signed and sealed by a Florida licensed engineer. Submit one copy each to A/E Engineer of Record and Volusia County Schools Building Department for code compliance review prior to installation of the system.

#### 1.7 PROJECT RECORD DOCUMENTS

- A. Submit project record documents.
- B. Accurately record actual locations of air terminals, grounding electrodes, bonding connections, and routing of system conductors.

#### 1.8 QUALIFICATIONS

- A. Manufacturer: Company specializing in lightning protection equipment with minimum five years documented experience and member of the Lightning Protection Institute.
- B. Installer: Authorized installer of manufacturer with minimum five years documented experience and member of the Lightning Protection Institute.

#### 1.9 PRE-INSTALLATION CONFERENCE

- A. Convene a pre-installation conference one week prior to commencing work of this Section.

#### 1.10 SEQUENCING AND SCHEDULING

- A. Coordinate the work of this Section with roofing and exterior and interior finish installations.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. Thompson Lightning Protection, Inc. - Premium Line
- B. Independent Protection Company, Inc. - Premium Line
- C. Heary Bros. Lightning Protection - Premium Line
- D. Harger Lightning Protection, Inc. - Premium Line

#### 2.2 MATERIALS

- A. Components: In accordance with ANSI/UL 96 and LPI.
- B. Air Terminals:
  - 1. Air Terminals shall be solid (aluminum or copper) as required to match roof conductors, and shall have proper base support for surface on which they are attached, and shall be securely anchored to this surface.
  - 2. Terminals shall be of such length as to comply with NFPA 780.
  - 3. Air Terminal for Chimney: Lead-coated copper.
- C. Conductors:
  - 1. Roof conductors shall consist of (aluminum or copper) complying with the weight and construction requirements of the code. Roof conductor material shall match and/or be



compatible with roof flashing material.

2. Down conductors shall be copper, and shall be provided where shown installed in PVC conduit and hidden within the structure.
  3. If routing of down conductor raceway is in location where PVC is not allowed per code, install in metal conduit to meet code and bond both ends.
- D. Fastener:
1. Conductor fasteners shall be of the same material as the conductor, having ample strength to support conductor.
- E. Connectors and Splicers:
1. Above grade and accessible: They shall be bronze or aluminum as required to be compatible with conductor being connected.
  2. Below grade or concealed: exothermic connections
- F. Ground Rods:
1. Ground rods shall comply with all requirements of Section 16171 Grounding and Bonding and Section 16090 Tests and Performance Verification.
  2. Install in ground wells in accessible area (not in sidewalks, unless specifically accepted by engineer).
- G. Ground Plate: Copper.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Verify that surfaces are ready to receive work.
- B. Verify that field measurements are as shown on shop drawings.
- C. Beginning of installation means installer accepts existing conditions.

#### 3.2 PROTECTION OF SURROUNDING ELEMENTS

- A. Protect elements surrounding work of this Section from damage or disfiguration.

#### 3.3 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install in accordance with UL 96A, ANSI/NFPA 780, and LPI.
- C. Install ground rods in accordance with Section 16171 Grounding and Bonding. Where conflict exists between the requirements of Section 16171 Grounding and Bonding and this Section, the most stringent shall govern.
- D. Installation shall be made in an inconspicuous manner with conductors coursed to conceal equipment as much as possible. Down conductors shall be concealed within structure, and shall be run in 1" conduit complying with NEC. See Paragraph 'F' below and NFPA 780 4.15.1.
- E. Where fasteners are to be mounted in masonry or structural work, they shall be furnished to the Masonry or Structural Contractor so they may be installed during construction of the project.
- F. Conductors concealed in steel reinforced concrete shall be installed, bonded, etc. per NFPA 780 4.15.3. Specific attention is brought to the requirements of NFPA 780 4.9.13 requiring down conductors to be connected to reinforced steel at its upper and lower extremities.
- G. Lightning protection system shall be bonded to metal bodies as required by NFPA 780 4.21.

1. The Contractor shall provide proper connection of the lightning protection system to all grounded media in and around the protected structure (see NFPA 780 4.20 Potential Equalization).
  2. The Contractor shall provide proper grounding of all grounding media in, on and around structure to provide common ground potential per NFPA 780 4.14, including electric service, telephone and antenna system grounds, underground metallic piping systems, underground metal conduits.
  3. All fences, gates, handrails, metal flagpoles, metal bleacher seats, metal playground equipment shall be grounded and bonded to the grid.
  4. Bond/ground all building mounted and/or grade mounted antennae and satellite systems/dishes.
- H. Provide proper connections of lightning protection system to all grounded media in and around the protected structure per NFPA 780 4.20 Potential Equalization.
- I. Provide proper grounding of all grounding media in, on and around structure to provide common ground potential per NFPA 780 4.14 including electric service, telephone and antenna system grounds as well as underground metallic piping systems, underground metal conduits, etc.
- J. All exposed conductors located 6' or less above finished floor or finished grade is to be suitably protected/shielded as well as other exposed locations where conductor is subject to mechanical damage.
- K. Coordinate and receive acceptance of all penetrations of roofing system and mounting to roofing system with Architect and Roofing Contractor prior to submittal of shop drawings.
- L. Coordinate and receive acceptance of all connections to structural steel, rebar, etc. with Structural Engineer prior to submittal of shop drawings.
- M. Submittal of shop drawing by Contractor is evidence that the Contractor has received acceptance of penetrations, connections, etc. by all parties and that Contractor assumes responsibility for such penetrations, connections, etc.
- N. Ground Terminals:
1. Ground connections shall be made in accordance with requirements of all applicable codes and Section 16171 Grounding and Bonding (including but not limited to requirements for testing, ground rods, materials, wells, etc.).
  2. Ground rods shall be placed outside, a minimum of 2' from building foundations. Top of rod shall be at least 1' deep into earth (i.e. with minimum earth cover of 1'. Install in ground well. Install gravel/rock in base of all ground well, from well bottom to minimum of 6" below well bottom.
  3. Each and every ground rod location shall consist of:
    - a) Two or more 30' ground rods (5/8" copper) at no less than 60' spacing shall be driven vertically to a depth resulting in 1' earth cover.
    - b) Bond the two or more ground rods together with a cable size that meets the applicable requirements of NFPA 780 for Class I or II locations as applicable.
    - c) Provide additional rod electrodes as required to achieve specified ground resistance.
    - d) Complete installation shall exceed the minimum requirements of NFPA 780.
    - e) Provide grounding well enclosure at each ground rod location in accordance with Section 16171 Grounding and Bonding.
- O. Install in accordance with OSHA Standard 29 CFR Regulations 1910.23(c)(3), 1910.212,

1926.50

3.4 FIELD QUALITY CONTROL

- A. Test grounds per Section 16171 Grounding and Bonding and 16090 Tests and Performance Verification.
- B. Obtain the service of Underwriters Laboratories to provide inspection and certification of the lightning protection system under provisions of UL 96A.
- C. Obtain UL master label and attached to building at location directed by Owner.
- D. Submit test results on each ground location including final length of each ground rod and final distance between each installed ground rod at each ground rod location.

END OF SECTION

SECTION 16691 - SURGE PROTECTIVE DEVICES

PART 1- GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes requirements for surge protective devices.

1.3 REFERENCES

- A. The latest edition of the following references shall apply to the work of this section:
  1. ANSI/IEEE C62.33 Standard Test Specifications for Varistor Surge Protective Devices
  2. ANSI/IEEE C62.41 IEEE Recommended Practice on Surge Voltages in Low-Voltage AC Power Circuits
  3. ANSI/IEEE C62.45 IEEE Recommended Practice on Surge Testing for Equipment Connected to Low-Voltage (1000V and Less) AC Power Circuits
  4. NFPA 70 National Electrical Code
  5. NFPA 780 Standard for Installation of Lightning Protection Systems
  6. UL 1363 Standard for Safety Relocatable Power Taps
  7. UL 1449 3rd Edition Standard for Safety for Surge Protective Devices

1.4 DESCRIPTION

- A. Provide and install all materials, labor and auxiliaries required to furnish and install complete surge suppression for the protection of building electrical and electronics systems from the effects of line induced transient voltage surge and lightning discharge as indicated on drawings or specified in this section for systems with voltages between 120 VAC and 208 VAC three phase.
- B. Equipment specified covers Surge Protective Devices (SPD).
- C. Provide surge protective devices for the following equipment:
  1. On each main electrical service panel at each building.
  2. On distribution and branch panels as called for on Drawings or in these Specifications.
  3. All electronic communications equipment installed as per all Sections of 16700 including, but not limited to, fire alarm, intercom, security, television, premise distribution, and sound systems.
  4. All or any electronic equipment installed under Division 16 including electronic time clocks, controls systems, etc.
  5. All or any electronic equipment installed under Division 15 including: electronic time clocks, halon systems, control systems, building management systems, etc.
  6. Site lighting pole light circuits.
  7. Additional locations as required by NFPA 780.
  8. At point of use locations (receptacles, plug-in units) as required.
  9. On all automatic transfer switches (ATS).

10. On all step-down or step-up transformers and voltage regulators as identified in the project drawings.

#### 1.5 SUBMITTALS

- A. Submit under provisions of the General Requirements of the Contract Documents and Section 16012 Submittals.
- B. Submit Product Data for each type of surge protective device:
  1. Dimensions.
  2. Means of mounting.
  3. Compliance with UL Standards referenced.
  4. Compliance with IEEE Standards referenced.
  5. Design type (Hybrid, MOV).
  6. Internal fusing.
  7. Recommended overcurrent protection.
  8. Size of wire leads.
  9. Visual failure indicator.
  10. Warranty.
  11. Performance data showing compliance with performance as specified herein.

#### 1.6 OPERATION AND MAINTENANCE DATA

- A. Submit operation and maintenance (O & M) data as called for in Section 16098 Operation and Maintenance Manuals.
- B. O & M data to include:
  1. All accepted shop drawings, product data, and/or cutsheets.
  2. Installation, connection, and maintenance information on each type of surge suppression.
  3. Procedure and/or time table for recommended periodic inspection of devices to determine continued usefulness.

#### 1.7 QUALITY ASSURANCE

- A. All surge protective devices shall be manufactured by a company normally engaged in the design, development, and manufacture of such devices for electrical and electronics systems equipment.
- B. The surge protective device manufacturer shall offer technical assistance through support by a factory representative and local stocking distributor. Factory representatives are to accept installation prior to Substantial Completion.

#### 1.8 REGULATORY REQUIREMENTS

- A. Equipment Certification: Surge protective devices shall be listed by Underwriters Laboratories shall bear the UL seal and be marked in accordance with referenced standard. Surge protective devices shall be UL listed and labeled for intended use.
- B. Surge protective devices shall be installed and located in accordance with requirements of all applicable National Fire Protection Association (NFPA) codes (including NFPA 70 and NFPA 780).
- C. Comply with all standards and guides as listed under "References" above.

1.9 COORDINATION/PROJECT CONDITIONS

- A. Verify proper grounding is in place.
- B. Verify proper clearances, space, etc. is available for surge protective devices.
- C. Coordinate so that proper overcurrent device, as recommended by manufacturer, is installed to feed each surge protective device.

1.10 WARRANTY

- A. All surge protective devices shall be warranted to be free from defects in materials and workmanship for a period of ten years.
- B. Any surge protective device which shows evidence of failure or incorrect operation during the warranty period shall be repaired or replaced by the manufacturer and installer at no cost to the Owner.

1.11 DEFINITIONS/ABBREVIATIONS

- A. VPR: UL Voltage Protection Rating
- B. MCOV: Maximum Continuous Operating Voltage
- C. SCCR: Short Circuit Current Rating
- D. IN: Inominal

PART 2 - PRODUCTS

2.1 GENERAL

- A. Surge protective devices shall be designed for the specific type and voltage of electrical service and shall provide clamping action for both normal (L-N) and common (N-G) mode protection.
- B. Surge protective devices shall be of a hybrid design, and include circuitry with tight, wave-tracking clamping characteristics.
- C. Surge protective devices shall be designed to withstand a maximum continuous operating voltage of not less than 115 percent of nominal RMS line voltage.
- D. Surge protective devices shall contain internal safety fusing to disconnect the surge protective device from the electrical source if the surge protective device fails, in order to prevent catastrophic failure modes.
- E. Surge protective devices shall be fail safe, shall allow no follow-through current, shall have repeated surge capability, shall be solid state, shall be self-restoring, and shall be fully automatic.
- F. Surge protective devices shall be UL 1449 listed under UL Category Code VZCA and shall be accepted for the location in which they are installed.

2.2 SERVICE ENTRANCE SURGE PROTECTIVE DEVICES.

- A. General: Provide service entrance surge protective devices on each main electrical service panel at each building and/or structure. Surge protective devices shall meet or exceed the following (in addition to requirements under 'General' above):
  - 1. Surge protective devices shall be tested per UL 1449 requirements to determine voltage protection rating (VPR).
  - 2. Surge protective devices shall be sequential surge tested as per IEEE C62.45, and shall withstand 1000 test cycles at 10 kA, Cat. C3 test criteria.
  - 3. Enclosure:
    - a) UL listed

- b) Fire retardant
  - c) NEMA as required for each location.
  - d) Surface Mounted or as required for each location.
- B. Modular design
- 1. Replaceable module design. The panel mounted surge protective device shall be designed with replaceable modules for purposes of in-service replacement.
  - 2. The surge protective device shall be designed with redundant back-up surge protection in the event of a module failure.
  - 3. Module status indicators shall be provided to indicate individual module status. When a module has failed, the module LED status indicator shall indicate said failure.
  - 4. Unit status indicators shall be provided to indicate the status of the complete surge protective device. The LED status indicators shall be located on the hinged front cover to redundantly indicate module or unit failure.
  - 5. Minimum Surge Capacity:
- 2.3 SECOND LEVEL SURGE PROTECTIVE DEVICES [AND UPS/ATS SYSTEMS].
- A. General. Provide second level surge protective devices on each second level of the distribution system (including sub panels) [and on all major electronic equipment including [UPS Systems] [and] [ATS Systems]]. Surge protective devices shall meet or exceed the following (in addition to requirements under 'General' above):
- 1. Surge protective devices shall be tested as per UL 1449 requirements to determine voltage protection ratings (VPR – 3 kA).
  - 2. Surge protective devices shall be sequential surge tested as per IEEE C62.45, and shall withstand 1000 test cycles at 3 kA, Cat. B3 test criteria.
  - 3. Enclosure:
    - a) UL listed.
    - b) Fire retardant.
    - c) NEMA rating as required for each location.
    - d) Surface mounted or as required for each location.
- 2.4 Exterior Lighting Poles Circuits.
- A. Provide surge arrester in pole handhole.
  - B. Surge arrester shall be UL listed as a Type 1 surge arrester.
- 2.5 Service Surge Arrester.
- A. Service Surge arrester shall be UL listed as Type 1 surge arrester and as required to comply with Local Authority Having Jurisdiction and UL 96A requirements.
  - B. This suppressor shall be connected on the line side of service to each building and where required to meet UL 96A.
  - C. 50 kA per phase rating.
  - D. Minimum short circuit current rating: 200,000 amps
  - E. Enclosure:
    - 1. NEMA 4X polycarbonate

- F. Manufacturers:
  - 1. Advanced Protection Technologies SPDEE Series for applied voltage
  - 2. Atlantic Scientific Zone Defender Curve Series for applied voltage
- 2.6 Point of Use Location (120 Volt).
  - A. UL 1449 Listed.
  - B. 20 Amp, 120V rated. All components must be 20 Amp rated.
  - C. Surge protection devices shall be tested per IEEE, C62.41 for Categories A and B.
  - D. Normal mode (L - N), and common mode (L+N-G) protection.
  - E. Internal fusing.
  - F. Hybrid design.
  - G. Indicators for normal operation and failure indication.
  - H. Enclosure:
    - 1. Fire retardant high impact, phenolic or plastic housing or metal enclosure.
  - I. Clamping voltage UL 1449, Line to Neutral, Category B impulse at (3 kA, 8 x 20  $\mu$ s): 350V @ 120V.
  - J. Maximum Surge Capacity: 26,000 Amps.
  - K. Maximum continuous operating voltage: 115 percent of line voltage.
  - L. Provide hardwire connection or add 20-amp receptacle device to hardwired devices to match equipment being protected and maintain UL Listing. Device shall be a feed-through design. Parallel connected devices are not acceptable.
  - M. Manufacturers:
    - 1. Leviton 51020-WM
- 2.7 Power Plug-in Units
  - A. UL 1449 Listed.
  - B. 15 Amp, 120V rated. All components must be 15 Amp rated.
  - C. Surge protection devices shall be tested per IEEE, C62.41.2 for Categories A and B.
  - D. Normal mode (L - N), and common mode (L+N-G) protection.
  - E. Internal fusing. Resettable circuit breaker.
  - F. Hybrid design.
  - G. Operational indicator lamp.
  - H. Enclosure:
    - 1. Fire retardant high impact, phenolic or plastic housing or metal enclosure.
  - I. Clamping voltage UL 1449, Line to Neutral, Category B impulse at (3KA, 8 x 20  $\mu$ s): 350V @ 120V.
  - J. Maximum Surge Capacity: 13,000 Amps.
  - K. Maximum continuous operating voltage: 115 percent of line voltage.
  - L. Manufacturers:



1. Control Concepts SP Series
2. Leviton
3. Wiremold

### PART 3 – EXECUTION

#### 3.1 GENERAL

- A. Provide, install and connect surge protective devices at first piece of electrical equipment (panel, switchboard, ATS, etc.) that the electrical service encounters as it enters the facility.
- B. Provide, install and connect surge protective devices at each branch panel as noted on drawings.
- C. Provide, install and connect surge protective devices at each Automatic Transfer Switch (ATS) in project whether shown on drawings or not.
- D. Provide, install and connect surge protective devices in pole near hand hole of all exterior lighting poles whether shown on Drawings or not.
- E. Provide, install, and connect surge protective devices at location where Section 16700 equipment is connected to line voltage (120V). Provide cords and receptacles as required to connect surge protective devices to equipment being protected and maintain UL listing.
- F. Provide surge protective devices at panel feeding exterior site lighting circuits and each circuit feeding site lighting.

#### 3.2 INSTALLATION OF SURGE PROTECTIVE DEVICES

- A. Surge protective devices for other than Section 16700 equipment shall be installed as close as practical to the electric panel or electronic equipment to be protected, consistent with available space.
- B. Surge protective devices for Sections 16700 to 16900 equipment power source shall be coordinated with the individual specification section contractor. Locate in terminal cabinet with surge protective devices and bond together.
- C. Surge protective devices shall be close nipped to the device being protected in a position near the neutral bus which will minimize lead length between surge protective devices and the buses or control breaker to which the surge protective device connects. Suppressor leads shall not extend beyond the surge protective device manufacturer's recommended maximum lead length without specific acceptance of the engineer.
- D. Location shown on drawings is diagrammatic only. Provide flush mount trim for surge protective device units at flush mounted panelboards. Provide NEMA 4X enclosures for TVSS units in exterior locations.
- E. Surge protective devices shall be installed in a neat, workmanlike manner. Lead dress shall be as short and as straight as possible and be consistent with recommended industry practices for the system on which these devices are installed.
- F. Supplementary grounding and bonding connections required between the bonding bus or ground plane for each equipment cluster and other locations as indicated herein shall be accomplished using #6 AWG core copper conductor and accepted connections unless otherwise noted. Referenced to a common earth ground.
- G. Surge protective devices shall be installed in a manner that allows simple replacement within short periods of downtime.
- H. Surge protective devices other than point of use type and those for exterior lighting poles shall be installed with a means of disconnecting the suppressor at the panel. At the main service

entrance location, provide a dedicated 30 amp, 3 phase CB, 100,000 AIC for the surge protective device. At the distribution secondary and/or subpanels location, provide dedicated 20 amp or 30 amp, 3 phase CB, for the surge protective device. Label disconnect or CB "Surge Protector." Fused disconnects may be substituted for the CB, with the acceptance of the Engineer. Contractor to change rating of CBs noted above as required to properly provide system as recommended by manufacturer.

END OF SECTION

SECTION 16721 - ADDRESSABLE FIRE ALARM/DETECTION SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. The work described herein and on the drawings consists of all labor, materials, equipment, and services necessary and required to provide and test an automatic fire detection and alarm system. Any material not specifically mentioned in this specification or not shown on the drawings but required for proper performance and operation shall be provided.
- B. The drawings and specifications herein comply to the best of the Engineer's knowledge with all applicable codes at the time of design. However, it is this Contractor's responsibility to coordinate/verify (prior to bid) the requirements of the Authority Having Jurisdiction over this project and bring any discrepancies to the engineer's attention at least seven days prior to bid. No changes in contract cost will be acceptable, after the bid, for work and/or equipment required to comply with the authority having jurisdiction.
- C. The Contractor is advised that circuit routing for this system is not necessarily shown on the project drawings. The contractor shall provide and install all raceways, wiring and cabling required for a complete and fully functional system as intended by these specifications. All wiring and/or cabling shall be in conduit. Contractor shall provide and install a properly sized, flush mounted outlet box for every device. Contractor shall size and route raceways to accommodate the proper installation of the system cabling. T-Tapped cabling shall not be acceptable. In locations where raceway and/or conduit is not accessible after completion of the project, conduit shall be routed from device to device or fire rated access panels shall be installed to provide access to junction and pull boxes. Routing of raceway from device to device shall only be acceptable where the wiring scheme of the system, as recommended by the manufacturer, requires cable to pass from device to device. Contractor shall properly terminate each device according to the manufacturer's recommendations. Provide and install firestopping where penetrations are made through rated walls and floors.
- D. The Contractor shall provide and install the Fire Alarm system (including all equipment, wiring, etc.) in accordance with the Manufacturer's recommendations.
  - 1. Installation of devices shall be in accordance with the Manufacturer's requirements as well as the requirements of the Contract Documents. Recommendations by the Manufacturer for the proper installation of the Fire Alarm system and its equipment shall not preclude the requirement for the Contractor to comply with the requirements of the Contract Documents.
  - 2. Termination of Fire Alarm circuits shall be in accordance with the Manufacturer's recommendations, applicable requirements of the National Electrical Code (NFPA 70), 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. The Fire Alarm Installer shall be responsible for ensuring that prior to bidding the project the Electrical Contractor understands the raceway requirements for the project. Claims by the Contractor after award of the project in regard to additional raceway required either by the Fire Alarm System Manufacturer's recommendations for proper installation of the

system and its associated equipment, or for compliance with the requirements of the Contract Documents, shall not be allowed.

- E. The Owner shall be responsible for any retrofits, installation and design required by the local AHJ to comply with the requirements of the 2010 Florida Fire Prevention Code Section 11.10. This code requirement can only be determined after the construction of the building and may or may not be required by the local AHJ in the area of this project.

### 1.3 DESCRIPTION

- A. The Contractor shall furnish and install a complete Addressable Analog Fire Detection system network. The system shall include but not be limited to:
1. Main Fire Alarm Control Panel (FACP) including all required power supplies
  2. Fire Alarm Annunciator Panel (FAAP)
  3. Manual Pull Stations
  4. Smoke Detectors
  5. Duct Detectors
  6. Heat Detectors
  7. Combination Audible/Visual devices (indoor and outdoor weatherproof as indicated on the drawings)
  8. Visual devices (indoor and outdoor weatherproof as indicated on the drawings)
  9. Remote fire alarm control panels (Network Nodes)
  10. Remote power supplies (Remote power supplies shall be in a UL Listed assembly and be provided by the same manufacturer as the Fire Alarm Control Panel (FACP)).
  11. UL Listed Dialer.
  12. Surge Suppression
  13. Programming.
  14. Grounding
  15. Firestopping
  16. Wire and cable labeling.
  17. Electrical power required to comply with all functions and operations called for in this section of the specifications. Contractor shall provide and install all 120 VAC circuits as required.
  18. Conduit, wire, wire fittings, terminal cabinets with plywood and terminal strips, and all accessories required to provide a complete operating system.
- B. The contractor shall furnish and install all equipment (raceways, wire/cable, circuit breakers, modules, relays, etc.) necessary, and as required by applicable code, to accomplish incidental functions of the fire alarm system including but not limited to the following:
1. Monitoring of Sprinkler System and/or Fire Protection System Flow and Tamper switches.
  2. Monitoring of Sprinkler System and/or Fire Protection System Valve Supervisory switches.
  3. Monitoring of Post Indicator Valve (PIV) switches.
  4. Gas/Fuel valve shutoff.
  5. HVAC system control and/or shutdown.

6. Ventilation system (supply fans, exhaust fans, fan terminal boxes, etc.) control and/or shutdown.
  7. Fire suppression and or extinguishing systems.
  8. Control of fire and/or smoke doors, dampers, shutters, etc.
  9. Computer room power panels and air conditioning control and/or shutdown.
  10. Connection to telephone tie lines, UL listed dialer, etc. required for monitoring of the fire alarm system.
- C. The system shall operate as a non-coded, continuous ringing system which will sound all audible devices and activate all visual devices until it is manually silenced. When system is silenced by silence switch in control panel, audible alarm is to silence but visual alarm devices are to continue to operate.
- D. The system shall be wired as a Class B system for all circuits.
- E. The system is to be a complete analog addressable system.
- F. All portions of fire alarm system shall be installed in conduit. Conduit and boxes to be installed by electrical contractor.
- G. The fire alarm system shall not share a raceway, junction box, enclosure, manhole or device with any other system.
- H. Contractor to advise owner of requirements for monitoring the fire alarm system by owner's monitoring company and provide all electrical required for remote monitoring.
- I. Provide and install wiring, equipment, etc. for connection to devices furnished under other divisions of the work.
- J. In buildings, two or more floors not fully sprinklered, provide communication equipment, in accordance with all applicable codes, for Areas of Rescue Assistance.
- K. Although they may not be indicated on the Fire Alarm system diagram and/or drawings, all required control and interlock wiring between the Fire Alarm system and building equipment shall be provided hereunder. Controls are required to/for/from:
1. Fire/smoke air and duct detectors
  2. Fire, smoke and/or combination fire/smoke dampers.
  3. Supply/Return fans, Exhaust fans, and/or Fan Terminal Boxes (FTB)
  4. Automatic fire extinguishing systems
  5. Sprinkler and/or Fire Protection system components
- L. Provide wiring for Post Indicator Valve Alarms, in each instance in which these are provided under work of Other Trades, connected to Fire Alarm System.
- M. Provide and install all relays (electric-electric, electric-pneumatic, and/or pneumatic-electric) as required for a complete and operational fire alarm system, complying with all applicable codes and all requirements, and coordinated with all divisions of these specifications.
- N. Provide terminal cabinets sized to house terminal strips and surge suppression equipment.
- O. Surge Suppression
1. The contractor shall have equipment installed on the AC voltage supply and other lines taking care to arrest damaging electrical transient and spikes which can cause damage to the microprocessor components of the system. Central office telephone lines shall have

equipment installed to arrest high voltages from electrical and/or lightning from entering the system and causing damage.

2. Provide and install all materials, labor and auxiliaries required to furnish and install complete surge suppression for the protection of building fire alarm system from the effects of induced transient voltage surge and lightning discharge as indicated on drawings or specified in this section.
3. Provide surge suppression equipment at the following locations:
  - a) On each conductor pair and cable sheath entering or leaving a building.
  - b) On each conductor associated with fire protection (sprinkler) system fire alarm connections.
  - c) On 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.

#### 1.4 STANDARDS, CODES, REFERENCES, AND REGULATORY REQUIREMENTS

- A. Reference Section 16014.
- B. The equipment and installation shall comply with the current or applicable provisions of the following standards:
  1. ANSI S3.41 Audible Emergency Evacuation Signal
  2. National Fire Protection Association Standards:
    - a) NFPA 70 National Electrical Code (including but not limited to Article 760, Fire Alarm Systems), Article 770 and Article 800.
    - b) NFPA 72 National Fire Alarm Code
    - c) NFPA 101 Code For Safety to Life from Fire in Buildings and Structures
    - d) NFPA 90A Installation of Air Conditioning and Ventilating Systems
  3. Underwriters Laboratories. The system and all components shall be listed by Underwriters Laboratories for use in fire protective signaling system under the following standards as applicable:
    - a) UL 864 (Category UOJZ) APOU Control Units for Fire Protective Signaling Systems. All Control Equipment shall be listed under UL category UOJZ.
    - b) UL 268 Smoke Detectors for Fire Protective Signaling Systems
    - c) UL 268A Smoke Detectors for Duct Applications
    - d) UL 217 Smoke Detectors Single Station
    - e) UL 521 Heat Detectors for Fire Protective Signaling Systems
    - f) UL 228 Door Holders for Fire Protective Signaling Systems
    - g) UL 464 Audible Signaling Appliances
    - h) UL 1638 Visual Signaling Appliances
    - i) UL 1481 Power Supplies for Fire Protective Signaling Systems
    - j) UL 1480 Speakers

- k) UL 1424 Cables
  - l) UL 1971 Signaling Devices for the Hearing Impaired
  - m) UL 1449 3rd Edition Standard for Safety for Surge Protective Devices
  - n) UL 497, UL 497A, UL 497B.
4. All fire alarm equipment, including accessories to the system and including all wires and cable unless otherwise noted, shall be listed by the Underwriters' Laboratories product directory called Fire Protection Equipment and/or the Electrical Construction Materials List.
  5. Each item of the fire alarm system shall be listed and classified by UL and FM as suitable for purpose specified and indicated.
  6. The system controls shall be UL listed for Power Limited Applications per NEC 760. All circuits must be marked in accordance with NEC article 760.
  7. All equipment supplied as part of the Fire Alarm System shall be provided by a single manufacturer and shall comprise a complete UL Listed Fire Alarm System.
  8. IEEE: The 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 C62.41-1980 (formerly IEEE Standard 587).
- C. The 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 –Safety Code for Elevators and Escalators
  4. Local and State Building Codes.
    - a) Florida Building Code:
    - b) Florida Administrative Code. All applicable chapters including but not limited to:
      1. Chapter 69A Rules, including but not limited to:
        - (a) Ch 69A-3 Fire Prevention - General Provisions.
        - (b) Ch 69A-19 Fire Prevention - Garages.
        - (c) Ch 69A-27 Fire Prevention - Places of Assembly.
        - (d) Ch 69A-43 (Florida Handicap Code - Lodging)
        - (e) Ch 69A-46 Fire Protection System Contractors and Systems.
        - (f) Ch 69A-47 Uniform Fire Safety Standards for Elevators.
        - (g) Ch 69A-48 Fire Safety Standards for the Fire Alarm Systems.
      2. Florida Building Code Chapter 423 SREF (Schools)
      3. Florida Administrative Code 10A-12 (Florida Handicap Code - Hospice)
      4. Florida Administrative Codes 33-8 (Jails)

- c) Florida Department of Insurance:
  - 1. Insurance Code: The fire alarm system and installation thereof shall comply with the State of Florida Department of Insurance rules. The requirements of the Florida State Department of Insurance shall be as promulgated by the Division of State Fire Marshal.
  - 2. Fire Alarm Rules: The fire alarm system and installation thereof shall comply with the Fire Safety Rules promulgated by the Florida State Fire Marshal.
- d) Authority Having Jurisdiction:
  - 1. General: The system shall comply with all applicable Codes, Ordinances and Standards as interpreted and enforced by the local authority having jurisdiction.
  - 2. Fire Department: NOTE: INSERT FIRE DEPARTMENT HAVING JURISDICTION HERE
  - 3. Building Official: NOTE: INSERT BUILDING DEPARTMENT HAVING JURISDICTION HERE
  - 4. State of Florida: Division of State Fire Marshal.

D. Surge Suppression

- 1. Equipment Certification: When available by any one manufacturer, all surge suppression equipment shall be listed by Underwriters' Laboratories, shall bear the UL seal and be marked in accordance with referenced standard. Such surge suppression equipment shall be UL listed and labeled for intended use.
  - 2. Comply with all standards and guides as listed under "References" above.
- E. Systems not capable of complete network interface operations as described in this specification shall supply a complete local area or wide area network with CRT/terminals at each location and shall obtain UL site certification and acceptance prior to the completion date. Certification shall not delay final system acceptance.

1.5 RELATED SECTIONS

- A. All applicable sections of Division 0, Division 1, and Division 16.
- B. Applicable sections of these specifications with regard to, but not limited to:
  - 1. Doors
  - 2. Standpipe and fire hose systems
  - 3. Sprinkler systems
  - 4. Extinguishing systems
  - 5. Ductwork accessories: smoke dampers
  - 6. Building control systems

1.6 QUALITY ASSURANCE

- A. Manufacturer: Company specializing in manufacturing the products specified in this section with minimum 10 years experience and with service facilities within 50 miles of Project.
- B. Manufacturer: Company specializing in manufacturing the products specified in this section with minimum 10 years experience and with service facilities capable of providing a maximum response time of 2 hours.
- C. Installer:



1. Company specializing in installing the products specified in this section with minimum 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 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 10 consecutive years going back from date of bid.
  6. The Installing Contractor shall maintain an office with capability to provide emergency service 7 days a week, 24 hour days, with a maximum response time of 2 hours. The Installing Contractor shall have been actively engaged in the business of selling installing and servicing fire alarm systems for at least 10 years going back from date of bid.
- D. Surge Suppression
1. All surge suppression devices shall be manufactured by a company normally engaged in the design, development, and manufacture of such devices for electronics/communications systems equipment.
  2. The surge suppressor manufacturer shall offer technical assistance through support by a factory representative and local stocking distributor.
  3. Verify proper clearances, space, etc. is available for surge suppressor.
- E. Coordination/Project Conditions
1. Verify proper grounding is in place.
  2. In installations where the electrical contractor does not provide a counterpoise system in conjunction with the underground raceway system, the fire alarm contractor shall provide a coupling conductor within the fire alarm underground raceway system to run along side fire alarm conductors. Coupling conductors shall be sized according to applicable codes and standards.
- F. To establish the type and operating characteristics of the fire alarm system, the equipment specified herein is used as a guide in determining the functions of the fire alarm system. Other equipment will be considered for acceptance provided the following is submitted in writing by the system installer to the Engineer (See Section 16013 on Substitutions):
1. Contractor qualifications (as listed above).
  2. Complete lists, descriptions and drawings of materials to be used.
  3. A complete drawing showing conduit, conduit sizes, backboxes, number of wires and wire sizes.
  4. A complete riser diagram of Fire Alarm System.
- G. Acceptable Manufacturers
1. Notifier
  2. Silent Knight
  3. Simplex

## 1.7 SUBMITTALS

- A. Submit in accordance with Sections 16010 and 16012.
- B. In addition to requirements of 16010 and 16012, the contractor shall submit:
  - 1. Narrative of operation of System as provided. (Submittal will not be reviewed by the A/E without this narrative.)
  - 2. Manufacturer's data on all products, including but not limited to:
    - a) Catalog cut sheets.
    - b) Roughing-in diagrams.
    - c) Installation instructions. Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of product.
    - d) Operation and maintenance manuals.
    - e) Typical wiring diagrams and risers.
    - f) The contractor shall submit test reports, manufacturers' specifications and any other information necessary to determine compliance with material and equipment specifications described herein.
  - 3. Submit floor plans to locate all devices. Wiring diagrams shall include wire and raceway sizes, fire alarm control panels riser wiring and associated raceway sizes, wiring details, connections and terminal identification. All devices shall be identified by the same applied identification symbol as shown on the contract documents.
  - 4. Submit all load calculations and cable/wire sizing for each branch of the individual fire alarm field circuits. Wire sizing calculations to prove maximum three percent (3%) voltage drop at all AC voltages and maximum eight percent (8%) voltage drop at all DC voltages.
  - 5. Battery sizing calculations.
  - 6. Submit a detailed step by step testing procedure for a component by component system functional checkout and test.
  - 7. Point to point wiring diagrams and block diagrams of system to be installed. Point to point wiring diagrams may be submitted at time of operation and maintenance manuals in lieu of in submittal brochure. Block diagrams shall be required with SUBMITTALS.
  - 8. Riser diagrams and floor plans showing conduit runs and number of wires. All devices shall be identified by the same applied identification symbol as shown on the drawings.
  - 9. Surge Suppression
    - a) Surge protective data for 120 volt power source, power circuit, outside signaling circuit, and exterior incoming circuits from other buildings (if any), and outgoing circuits to other buildings (if any).
    - b) Submit Product Data for each type of suppressor:
      - 1. Dimensions.
      - 2. Means of mounting.
      - 3. Compliance with UL Standards referenced.
      - 4. Compliance with IEEE Standards referenced.
      - 5. Design type (Hybrid, MOV).

6. Size of wire leads.
  7. Warrantee.
  8. Performance data showing compliance with performance as specified herein.
  9. Complete schematic data on each suppressor type indicating component values, part number, conductor sizes, etc.
  10. Manufacturer's certified test data on each suppressor type.
  11. Test data from an independent test laboratory.
10. Name, qualifications, etc. of company providing and installing system.
  11. Qualifications of installer. Submit proof installer meets specified requirements.
  12. Proof of UL Listing. Indicate the UL listing, the UL classification, and NEC insulation type used for each type of wire to be used in installation of fire alarm and communications system.
  13. Manufacturer's drawings showing all dimensions (height, width, and depth) for all cabinets used to house system components. Provide catalog pages, mounting details and specification sheets for all fire alarm system components and rough-in boxes.
  14. Submit Florida Registered Firm certificate number.
  15. Submit Florida Fire Alarm Contractor's license number.
  16. Submit Fire Alarm Technician(s) Manufacturer's certification.
  17. Detailed drawing of the Fire Alarm Control Panels layout indicating the exact arrangement of all zones, including expansion zones.
  18. Coordination Drawing: Coordination CAD drawing of building Fire Command room and equipment layout as shown on drawings, with all panel and rack footprints, using actual manufacturer's dimensions, indicating proper clearances.
  19. Network:
    - a) Complete description data indicating UL listing for all network components.
    - b) Complete sequence of operation of all functions of the network.
    - c) A list of every network node address.
    - d) A list of every address of every device connected to a network node that is provided for purposes of alarm initiation, status monitoring, supervised notification appliance circuits, and auxiliary control.
    - e) Complete network wiring diagrams for all components and interfaces to equipment supplied by others.
  20. All drawings required herein shall be on AutoCAD 2007 or higher.
  21. Where required by Authority Having Jurisdiction submit signed and sealed documents as required by Authority Having Jurisdiction. Where Authority Having Jurisdiction requires shop drawings to be signed and sealed by a Registered Engineer, Contractor is required to submit same and include in his bid all costs associated with having a Registered Engineer other than the design Engineer of Record perform signing and sealing.
- 1.8 PROJECT RECORD DOCUMENTS
- A. Submit in accordance with Sections 16010 and 16098.
  - B. In addition to the requirements of 16010 and 16098, the contractor shall submit:

1. Updated and revised contract documents to record actual locations (as-installed) of all equipment, devices, initiating devices, signaling appliances, and end-of-line devices.
2. Record actual type, size, and routing of cables installed.
3. Record all cable identifications.
4. Drawings required herein are in addition to those required under "OPERATION AND MAINTENANCE DATA".
5. All drawings required herein to be on AutoCAD 2007 or higher.

1.9 OPERATION AND MAINTENANCE DATA

- A. Submit in accordance with Sections 16010 and 16098.
- B. In addition to the requirements of 16010 and 16098, the contractor's O & M Manuals shall include:
  1. A complete as-installed equipment list, listed by room, with manufacturers' names, model numbers, serial numbers, and quantities of each item.
  2. A complete and correct system schematic, showing detailed connections for all parts of the system, including wire numbers, terminal block numbers and layouts, and other designations and codings (point-to-point wiring diagrams). System performance measurements shall be documented as noted elsewhere in this specification.
  3. Riser diagrams showing as-installed conduit with pull boxes, outlet boxes, physical cable layouts, part numbers of cable types used, and number of circuits in each conduit.
  4. Repair parts list for each and every major equipment item furnished.
  5. Service manuals for each and every major equipment item furnished.
  6. Manufacturer's warranties and operating instructions for each and every equipment item furnished. Include a copy of the certificate of warranty, signed by both parties.
  7. Technical Systems Operations Manual, custom-written by the Contractor, for the purpose of instructing the Owner's operating personnel in the detailed step-by-step operation of the system and preventive maintenance procedures. This manual shall include descriptions of the system components and their relationship to system function. This manual shall be bound separately and labeled appropriately.
  8. Surge Suppression
    - a) O & M data to include:
      1. All accepted shop drawings, product data, and/or cutsheets.
      2. Installation, connection, and maintenance information on each type of surge suppression.
      3. Procedure and/or time table for recommended periodic inspection of devices to determine continued usefulness.
  9. Complete equipment rack layouts showing locations of all rack mounted equipment items.
  10. CAD floor plans, prepared at a scale of not less than 1/16" = 1'-0" showing detectors, speaker locations and orientation, rack locations, and all other related device locations.
  11. The Contractor/Installer shall videotape the entire training session(s), and submit the video tape with the Operational Manual.
- C. Drawings required herein are in addition to those required under "PROJECT RECORD DOCUMENTS".

1. All drawings required herein shall be on AutoCAD 2007 or higher. .

#### 1.10 WARRANTY

- A. The contractor shall warrant the equipment to be new and free from defects in material and workmanship, and will, within one year from date of acceptance by owner, repair or replace any equipment found to be defective.
  1. No charges shall be made by the installer for any labor, equipment, or transportation during this period to maintain functions.
  2. Respond to trouble call within 24 hours after receipt of such a call.
- B. The contractor shall guarantee all wiring and raceways to be free from inherent mechanical or electrical defects for 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 5 years.
  2. Any suppressor which shows evidence of failure or incorrect operation during the warranty period shall be repaired or replaced by the manufacturer and installer at no cost to the owner.
  3. Equipment that is damaged by surges during warrantee period shall be replaced at no expense to Owner.

#### 1.11 ADDITIONAL DEVICES FOR JURISDICTIONAL COMPLIANCE

- A. Prior to bid, Contractor shall review plans and specifications carefully for compliance with all codes, and in particular the ADA requirements and NFPA 72. Contractor shall include in bid price any devices required to provide a fully compliant system. Said additional devices shall be shown on shop drawings submitted by Contractor.
- B. In addition to the above-mentioned devices, Contractor shall include in his bid price the cost of installing twenty additional audible/visual notification devices (over and above those shown on drawings, required by specifications, or determined by system installed to be required) whose location/need may not become apparent until just prior to substantial completion date. At least two weeks prior to substantial completion system shall be fully operational. After system is operational, Owner's safety representative and the system installer shall review the placement of and coverage provided by visual and audible signals throughout the facility for compliance with all codes, and in particular the ADA requirements and NFPA 72. System installer shall provide the additional devices at locations where the Architect/Engineer requests for complete coverage. The additional devices shall be installed and fully operational prior to date of Substantial Completion.
- C. After the project has had its first annual safety inspection, the system installer shall install within one weeks notice any additional audible/visual signals that have been determined to be required during said inspection from the balance of the twenty additional devices noted above. There shall be no cost for these added devices provided the total does not exceed the balance remaining of the twenty devices noted above. The final balance of the twenty additional devices included in bid price shall be turned over to the Owner as spare material after any fire alarm issues identified during the first annual safety inspection are resolved.

#### 1.12 MAINTENANCE SERVICE

- A. Furnish service and maintenance of fire alarm system for one year from date of Substantial Completion.
  1. No charge shall be made by the installer and/or contractor for any labor, equipment, or transportation during this period to maintain functions.

2. Respond to trouble call within twenty-four hours after receipt of such call.

#### 1.13 EXTRA MATERIALS

- A. Provide six (6) keys of each type.
- B. Provide three (3) of each type of automatic smoke detector without base.
- C. Provide three (3) of each type of surge suppression device.

#### 1.14 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. 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.)

#### 1.15 SYSTEM OPERATION

- A. System operation shall meet the operation requirements of all codes and regulatory requirements.
- B. Upon activation of the Fire Alarm System by a manual station, smoke detector, or any other new or existing automatic device, (except AHU smoke duct detector) the following shall take place:
  1. Energize all alarm signaling devices.
  2. Sound all audible alarms and flash visual signals throughout the campus. (See Item 9 below)
  3. Alert local fire department or proprietary system.
  4. Cause alarm to be displayed on the annunciator section of the control panel.
  5. Cause alarm to be displayed on remote annunciator
  6. Close all doors or fire shutters, held open by automatic release devices throughout the facility, or by zone (coordinate with architect and door hardware supplier, provide all electrical required).
  7. Unlock all electrically locked time-out room doors (coordinate with the architect and door hardware supplier, provide all electrical required).
  8. Shut down all air handlers, exhaust fans supplying or exhausting air, and fan terminal boxes (FTB).
  9. Shut down of air handling unit by a local smoke duct detector shall not activate audible alarms or flash visual signals, but shall provide a supervisory indication at the fire alarm control panel/fire alarm annunciator.
  10. Shut all fire and/or smoke dampers in ducts associated with the air handling units and exhaust fans which are shut down.
  11. Transmit signals to the building automation system to tell system that the fire alarm system has taken control of respective mechanical system.
  12. Send a signal to all dimming and lighting relay/control systems. Fire alarm signal shall initiate dimming system controls to drive all dimmed circuits to immediate full-on output.

Fire alarm signal shall initiate lighting relay/control system to turn on all emergency lighting circuits.

- C. System operation shall meet the operation requirements of all codes and regulatory requirements.
- D. Upon activation of the Fire Alarm System by a manual station the following shall take place:
  - 1. Energize all alarm signaling devices.
  - 2. Sound all audible alarms and flash visual signals throughout the building.
  - 3. Alert local fire department or proprietary system.
  - 4. Cause alarm to be displayed on the annunciator section of the control panel.
  - 5. Cause alarm to be displayed on remote annunciator
  - 6. Close all doors, held open by automatic release devices throughout the facility, or by zone (coordinate with architect and door hardware supplier, provide all electrical required).
  - 7. Unlock all electrically locked doors (coordinate with architect and door hardware supplier, provide all electrical required).
- E. Upon activation of the Fire Alarm System by any smoke detector, any sprinkler flow alarm switch or other automatic detection device, the following shall take place in addition to the above:
  - 1. Shut down all air handlers and exhaust fans supplying or exhausting air in at least the zone where the alarm is initiated.
  - 2. Shut all smoke dampers in ducts associated with the air handling units and exhaust fans which are shut down, in at least the zone where the alarm is initiated. (Coordinate with mechanical contractor and provide all electrical as required).
  - 3. Transmit signals to building elevator control panel to initiate return to main floor or alternate floor.
  - 4. Transmit signals to building automation system to tell system that the fire alarm system has taken control of respective mechanical system.
  - 5. Send a signal to all dimming and lighting relay/control systems. Fire alarm signal shall initiate dimming system controls to drive all dimmed circuits to immediate full-on output. Fire alarm signal shall initiate lighting relay/control system to turn on all emergency lighting circuits.
  - 6. Send a signal to all non-fire alarm sound reinforcement systems. Fire alarm signals shall override all other sound systems. Alarm notification signals shall take precedence over all other signals. Operation of other sound systems shall resume after fire alarm system clears alarm.
- F. System supervisory faults, such as shorts, opens, and grounds in conductors, operating power failure, or faults within supervised devices, shall place the system in the trouble mode, which causes the following system operations:
  - 1. Visual and audible trouble signal indicated by zone at the fire alarm control panel.
  - 2. Visual and audible trouble signal indicated at remote annunciator panel.
  - 3. Trouble signal transmitted to central station.
  - 4. Manual acknowledgement function at fire alarm control panel shall silence audible trouble signal; visual signal shall be displayed until initiating failure or circuit trouble is cleared.
- G. Alarm Reset: The system shall remain in the alarm mode until manually reset with a key accessible reset function. The system shall reset only if the initiating circuits are cleared.

- H. Lamp Test: manual lamp test function causes alarm indication at each lamp on the fire alarm control panel and the remote annunciator.
- I. When the fire alarm system is activated as a drill, all incidental functions shall be exercised including notification of the fire department.
- J. Where required by codes or authority having jurisdiction:
  - 1. When system is silenced by silence switch in control panel, audible alarm is to silence but visual alarm devices are to continue to operate.
- K. The fire sprinkler valve tamper switch, when closed, shall annunciate a supervision signal at the fire alarm control panel and annunciator panels, if any. This supervision signal shall not cause a general alarm.
- L. Operation of auxiliary contacts in control panel to shut all smoke dampers in ducts associated with air handling units and exhaust fans which are shut down. (These shall not be controlled from detector unit contacts.)

#### 1.16 ZONING

- A. Alarm Zones.
  - 1. Regardless of the number of zones shown on drawings, the minimum alarm zones required are:
    - a) One per building, per floor for pull stations.
    - b) One per building, per floor for automatic devices.
    - c) One for each duct smoke detector.
    - d) Each device shall be an annunciated point.
- B. Notification Zones.
  - 1. Regardless of the number of zones shown on drawings the minimum notification zones (horns and strobe lights) required are:
    - a) One (or more) circuit(s) for administration building
    - b) One (or more) circuit(s) for exterior horns
    - c) One (or more) circuit(s) for remainder of campus.
  - 2. Breakdown circuits as required for load and distances involved.
- C. Alarm Zones.
  - 1. Regardless of the number of zones shown on drawings, the minimum alarm zones required are:
    - a) One per 3000 square feet per floor, for pull stations and heat detectors.
    - b) One per 3000 square feet per floor, for smoke detectors.
    - c) One for each duct smoke detector.
- D. Notification Zones.
  - 1. Regardless of the number of zones shown on drawings the minimum notification zones (horns and strobe lights) required are:
    - a) One per floor. Breakdown circuits as required for load and distances involved.

#### PART 2- PRODUCTS

##### 2.1 GENERAL EQUIPMENT AND MATERIAL REQUIREMENTS



- A. All equipment shall be new and unused. All components and systems shall be designed for uninterrupted duty. All equipment, materials, accessories, devices, and other facilities covered by this specification or noted on the contract drawings shall be the best suited for the intended use and shall be provided by a single manufacturer.

## 2.2 RACEWAYS

### A. General:

- 1. All raceways (conduit, wireways, pullboxes, outlet boxes, etc.) shall comply with applicable requirements of sections within Division 16 of these specifications.
- 2. All raceways (conduit, wireways, pull boxes, outlet boxes, etc.) shall comply with all requirements of the manufacturer of the fire alarm system.

### B. Conduit: Comply with Section 16111 except as noted below:

- 1. Pull Cords: Install pull cords in all raceway runs that are installed without cable.
- 2. Size: Minimum size shall be 3/4" conduit.

### C. Boxes:

- 1. All outlet boxes, junction boxes, pull boxes, etc. shall comply with applicable section of these specifications.
- 2. Boxes shall be sized as required by the fire alarm system manufacturer and NEC for cables and/or device installed.

## 2.3 TERMINATION CABINETS

- A. Terminal cabinets are to comply with applicable sections of these specifications.

## 2.4 "SYSTEMS" AND "LOCAL" GROUND BUS

- A. Bus to comply with applicable sections of these specifications.

## 2.5 FIRE ALARM CONTROL PANEL (FACP)

### A. General

- 1. The fire alarm control panel shall be of dead front construction and be modular in design. The control panel shall be capable of future expansion and shall provide active signal initiating as noted on drawings (or as herein) specified with zones as noted on drawings (or as herein specified). The control panel shall provide provisions for future expansion. The fire alarm control panel shall be semi-flush mounted (unless otherwise noted on drawings) and located as shown on the drawings.

### B. System Capability

- 1. Communication with addressable devices: The system must provide communication with all initiating and control devices individually. All 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-six (96) addressable devices and ninety-six (96) 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. The 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. The system shall be capable of communication with a minimum of fifteen (15) remote module locations.
- C. Master Controller
1. The master controller shall be an integral part of the control panel and be microprocessor-based.
  2. The master controller shall store all programming in non-volatile memory.
  3. The master controller shall have an event log capable of storing a minimum of two hundred fifty-five (255) events in non-volatile memory.
  4. The master controller shall include an eighty (80) character Liquid Crystal Display.
  5. The master controller shall include, as a minimum, switches to accomplish Alarm/Trouble Acknowledge, Alarm Silence, Trouble Silence and System Reset.
  6. The master controller shall include, as a minimum, LED's to indicate System Alarm, System Trouble, Supervisory Alarm and System Silence.
  7. The master controller shall support connection of serial remote annunciators.
  8. The master controller shall provide a minimum of two (2) notification appliance circuits (Class A or B, Style Z or Y).
  9. The master controller shall be capable of being expanded as necessary to accommodate all required modules.
- D. Notification Appliance Circuits
1. The Notification Appliance Circuits Module shall provide fully supervised style Z or Y (Class A or B) notification circuits. These circuits shall supervise and power polarity reversing loops containing up to 1.75 amperes of 24 Volt notification devices.
  2. An expansion printed circuit board shall be provided for this module to extend its capability to 8 such notification circuits.
  3. The module shall be provided with pluggable contact wiring terminal strips for ease of installation and service. The terminal strips shall be UL listed for 12 AWG wiring.
- E. Control panel shall include all equipment required to alert fire department and/or owner's monitoring service.
- F. Power Supply
1. The power supply for the panel and all fire alarm peripheral shall be integral to the control panel. The power supply shall provide all control panel and peripheral power needs as well as 3.0 amperes of unregulated 24 VDC power for external audio-visual devices. The audio-visual power may be increased as needed by adding additional modular expansion power suppliers. All power supplies shall be designed to meet UL and NFPA requirements for power-limited operation on all external signaling lines, including initiating circuits and indicating circuits.

2. All power supplies shall be provided by the same manufacturer as the fire alarm control panel (FACP). Power supplies provided by manufacturers other than the manufacturer of the fire alarm control panel (FACP) shall not be acceptable.
3. Circuit breakers, or other over-current protection on all power outputs.
4. Input power shall be 120 VAC, 60 Hz. The power supply shall provide internal batteries and charger. Internal battery capacity shall be as required.
5. The battery pack shall provide maximum normal operating and supervisory power for:
  - a) 60 hours per NFPA 72.
  - b) Provide low maintenance gel cell type batteries with sufficient ampere-hour rating to meet the above NFPA Standard and to operate all alarm signals for a duration of 15 minutes at the end of the required period of time.

G. Modem

1. A modem shall be provided as an integral part of the fire alarm control panel (FACP). The modem shall provide the Owner with the ability to accomplish the following functions:
  - a) View device sensitivity information.
  - b) View system activity in real time.
  - c) Access and view the system history log.
2. The modem shall not allow changes to system programming.
3. The modem shall operate at a minimum speed of 9600 baud.
4. The modem shall provide an RJ-11 connector for connection to a telephone line.
5. The fire alarm contractor shall coordinate with the Premise Distribution System (PDS) contractor and/or the Telephone System contractor for interconnection to a telephone line. Telephone interconnection wiring up to the modem shall be provided by the PDS or Telephone contractor.
6. The modem shall mount inside the fire alarm control panel (FACP).

H. Wall Mount Equipment Enclosure

1. The control panel, and all associated equipment, shall be housed in an enclosure designed for mounting directly to a wall or vertical surface. The back box and door shall be constructed of 16 gauge steel with provisions for electrical conduit connections into the sides and top. The door shall provide a key lock and shall include a glass or other transparent opening for viewing of all indicators.
2. The enclosure(s) shall be of sufficient size to house all equipment required for this project. All equipment shall be mounted in the enclosure(s) as designed by the manufacturer. Provide enclosures in quantities as required to provide a complete, UL Listed Fire Alarm system.

2.6 REMOTE ANNUNCIATOR

- A. The Fire Alarm Annunciator Panel (FAAP) shall be a serial annunciator panel and must be capable of being mounted in a remote location.
- B. The annunciator shall be modular using low current circuitry. The annunciator shall be capable of operating on nominal 24 Vdc and be battery backed up.
- C. The annunciator modules shall be capable of activating local or remote LED's, relays or graphic panels.

- D. All switches shall be a point in the system and be capable of controlling any system output or functions. All LED's and outputs shall be capable of being controlled by any change of state in the system or as a result of a time control, sequence or logic function. The LED's and switches shall be able to be clearly marked by the end user.
- E. The modular components of the annunciator shall be mounted in a recessed cabinet with hinged door and a lexan window with keylock.

#### 2.7 MANUAL STATION (NON-BREAK GLASS)

- A. Manual fire alarm station shall be non-code, non break glass type providing noncoded signals and operating with a double action motion. Upon actuation, they shall not be restorable to normal except by use of a key. The key shall also allow stations to be tested nondestructively. The stations shall be constructed of high impact, flame retardant Lexan or metal with operating directions provided on the cover in highlighted, embossed lettering. The words "FIRE ALARM" shall appear on the door in embossed letters one-half inch high or larger. Mount at 48" above finished floor to top and in accordance with NFPA and handicap standards. Manual stations shall be UL listed. Unit shall be equipped with an addressable interface module.

#### 2.8 PHOTOELECTRIC SMOKE DETECTOR

- A. The contractor shall furnish and install Analog addressable photoelectric smoke detectors, as called for on drawings. The combination detector head and twist-lock base shall be UL-listed compatible with a UL-listed fire alarm panel.
- B. The smoke detector shall have a flashing, status-indicating LED for visual supervision. When the detector is actuated, the flashing LED will latch on steady and at full brilliance. The detector may be reset by actuating the control panel reset switch.
- C. The sensitivity of the detector shall be monitored without removal of the detector head. Metering test points shall be accessible on the exterior of the detector head. Field adjustment of the sensitivity shall be possible when conditions require a change.
- D. The vandal-resistant, security locking feature shall be used in those areas as indicated on the drawings. The locking feature shall be field removable when not required.
- E. It shall be possible to perform a functional test of the detector without the need of generating smoke. The test method must simulate effects of products of combustion in the chamber to ensure testing of all detector circuits.
- F. To facilitate installation, the detector shall be nonpolarized. By using a furnished wire jumper, it shall be possible to check circuit loop continuity prior to installing the detector head.
- G. Voltage and RF transient suppression techniques shall be employed to minimize false alarm potential. A gated alarm output shall be used for additional detector stability.

#### 2.9 IONIZATION SMOKE DETECTOR

- A. The contractor shall furnish and install Analog addressable ionization smoke detectors, as called for on drawings. The combination detector head and twist-lock base shall be UL-listed compatible with a UL-listed fire alarm panel.
- B. The smoke detector shall have a flashing, status-indicating LED for visual supervision. When the detector is actuated, the flashing LED will latch on steady and at full brilliance. The detector may be reset by actuating the control panel reset switch.
- C. The sensitivity of the detector shall be monitored without removal of the detector head. Metering test points shall be accessible on the exterior of the detector head. Field adjustment of the sensitivity shall be possible when conditions require a change.
- D. The vandal-resistant, security locking feature shall be used in those areas as indicated on the drawings. The locking feature shall be field removable when not required.

- E. It shall be possible to perform a functional test of the detector without the need of generating smoke. The test method must simulate effects of products of combustion in the chamber to ensure testing of all detector circuits.
- F. To facilitate installation, the detector shall be nonpolarized. By using a furnished wire jumper, it shall be possible to check circuit loop continuity prior to installing the detector head.
- G. Voltage and RF transient suppression techniques shall be employed to minimize false alarm potential. A gated alarm output shall be used for additional detector stability.

#### 2.10 DUCT MOUNTED SMOKE DETECTOR

- A. The Duct Mounted Smoke Detector for the fire and smoke detection system shall be a high velocity rated Analog addressable series smoke detector intended for use with ventilation and conditioning ducts.
- B. The detector shall provide detection of combustion gases and smoke in air conditioning ducts in compliance with NFPA 90A. The detector shall be UL-listed specifically for the use in air handling systems.
- C. The detector shall operate at air velocities ranging from 300 feet per minute to 4000 feet per minute without requiring compensation for operation at specific air velocities. Sampling tubes of proper length shall be provided and installed to match duct width at the installed location.
- D. Whether shown on drawings or not, a remote alarm indicator/test station shall be provided for each duct mounted smoke detector to annunciate smoke detector operation remotely. Mount unit in ceiling or wall near respective remote smoke detectors (in an occupied space).

#### 2.11 HEAT DETECTORS

- A. The contractor shall furnish and install Analog addressable heat detectors, as called for on drawings. The combination detector head and twist-lock base shall be UL-listed compatible with a UL-listed fire alarm panel.
- B. The 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. The detector may be reset by actuating the control panel reset switch.
- C. Fixed temperature automatic heat detectors shall be rated at 135°F. The fixed temperature element shall use dual thermistor technology. Detectors shall have a smooth ceiling rating of 625 square feet and 2 Form 'A' contacts with rating of 3 amps at 6 to 125 volts A.C. and 1 amp at 6 to 28 volts D.C.
- D. Detectors shall be installed in accordance with appropriate articles of National Fire Protection Association and the spacing rating assigned by the Underwriters Laboratories and located as shown on the drawings. Automatic heat detectors shall be Underwriters Laboratories and Factory Mutual approved.
- E. Where indicated on the drawings the contractor shall provide heat detectors rated, by the manufacturer, as explosion proof. If not an integral part of the heat detector assembly, the addressable module shall be located outside the area protected by the explosion proof heat detector (but interior to the building) in an accessible area. If the addressable module is located above a gypboard ceiling the contractor shall provide a fire rated access panel.

#### 2.12 ADDRESSABLE MODULE

- A. Analog addressable device shall be furnished as required to monitor fire alarm or supervisory initiating devices or control auxiliary functions. Each module shall contain address switches to assign a unique input point for programming or control by the system.

#### 2.13 RELAYS

- A. Relays required for control (i.e. Air Handler shutdown, Supply Fan shutdown, Exhaust Fan shutdown, Fan Terminal Box shutdown, Door Lock release, Fire Shutter release, Smoke Damper closure, Fire Damper closure, Smoke/Fire Damper closure, or any other interface required by these specifications or applicable codes) shall be UL Listed relays suitable for use in Fire Alarm systems.
- B. Per NFPA, relays used for control of other systems shall be located within three feet (3') of the device to be controlled.
- C. Relays shall be analog addressable devices powered and controlled from the fire alarm system. Each relay shall contain address switches to assign a unique input point for programming or control by the system.
- D. Each relay shall provide at least one set of Form "C" dry relay contacts.

#### 2.14 AUDIBLE NOTIFICATION DEVICES

- A. Audible notification devices shall be wall mounted at each location designated on the drawings and/or as specified herein.
- B. The audible notification device shall include screw terminals for in-out field wiring. The device shall surface mount to a standard 4" sq. x 2 -1/8" backbox.
- C. The audible notification devices shall be UL listed for fire protective service and shall provide 24 VDC inputs and sound output of not less than 75 dBA measured at 10 feet or more than 120 dBA at the minimum hearing distance from the audible appliance.
  - 1. The audible notification device shall compliant with ANSI S3.41 for signal character conformance.
- D. Audible notification devices located on the exterior of a building, or in a damp or wet location, shall be a weatherproof version and rated, by the manufacturer, for use in wet locations.

#### 2.15 AUDIBLE/VISUAL NOTIFICATION DEVICES

- A. Audible/visual notification devices shall be wall mounted at each location designated on the drawings and/or as specified herein.
- B. The 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.
- C. The audible portion of the audible/visual notification devices shall be UL listed for fire protective service and shall provide 24 VDC inputs and sound output of not less than 75 dBA measured at 10 feet or more than 120 dBA at the minimum hearing distance from the audible appliance.
  - 1. The audible portion of the audible/visual notification device shall compliant with ANSI S3.41 for signal character conformance.
- D. The audible portion of audible/visual notification devices located on the exterior of a building, or in a damp or wet location, shall be a weatherproof version and rated, by the manufacturer, for use in wet locations.
- E. The visual portion of the audible/visual notification devices shall comply with the Americans with Disabilities Act which includes the following:
  - 1. The lamp shall be a xenon strobe type or equivalent.
  - 2. The color shall be clear or nominal white (i.e. unfiltered or clear filtered white light).
  - 3. The maximum pulse duration shall be two-tenths of one second (0.2 sec) with a maximum duty cycle of 40 percent. The pulse duration is defined as the time interval between initial and final points of 10 percent of maximum signal.

4. The intensity shall be a minimum of 75 candela. The use of visual devices rated at 15/75, 15 or 30 candela shall not be acceptable. Field selectable devices may be utilized provided the device is set at 75 candela or higher and the setting of the device selector switch is visible when the device is installed.
5. The flash rate shall be a minimum of 1 Hz and a maximum of 3 Hz.
6. More than two visible notification appliances in the same room or adjacent space within the field of view must flash in synchronization. This requirement shall not preclude synchronization of appliances that are not within the same field of view.

#### 2.16 VISUAL NOTIFICATION DEVICES

- A. Visual notification devices shall be wall mounted at each location designated on the drawings and/or as specified herein. Visual notification devices shall be of the flashing type in compliance with Americans with Disabilities Act.
- B. The visual notification devices shall comply with the Americans with Disabilities Act which includes the following:
  1. The lamp shall be a xenon strobe type or equivalent.
  2. The color shall be clear or nominal white (i.e. unfiltered or clear filtered white light).
  3. The maximum pulse duration shall be two-tenths of one second (0.2 sec) with a maximum duty cycle of 40 percent. The pulse duration is defined as the time interval between initial and final points of 10 percent of maximum signal.
  4. The intensity shall be a minimum of 75 candela. The use of visual devices rated at 15/75, 15 or 30 candela shall not be acceptable. Field selectable devices may be utilized provided the device is set at 75 candela or higher and the setting of the device selector switch is visible when the device is installed.
  5. The flash rate shall be a minimum of 1 Hz and a maximum of 3 Hz.
  6. More than two visible notification appliances in the same room or adjacent space within the field of view must flash in synchronization. This requirement shall not preclude synchronization of appliances that are not within the same field of view.

#### 2.17 ELEVATOR WARNING LIGHT WITH FLASHER

- A. Provide complete, indicating light with flasher per FAC 69A-47. Install label as required.

#### 2.18 WEATHERPROOF COVER (FOR AUDIBLE AND/OR VISUAL DEVICES)

- A. Constructed of clear polycarbonate.
- B. For flush or surface mount devices.
- C. Provide slotted version for audible/visual devices.
  1. Maximum of 5 dB loss.
  2. Provide with brass weep hole.
- D. Provide unslotted version for visual only devices.
  1. Maximum of 3 candela light intensity loss up to 110 candela light source.
  2. Provide without weep hole.
- E. Provide with weather gasket.
- F. Spacers for additional depth as required.
- G. Provide with tamper proof screws.

H. Design criteria:

1. Safety Technology International, Inc. #1220 (audible/visual) or #1221 (visual) series.

2.19 SURGE SUPPRESSION

A. Non-Addressable Initiation Devices:

1. Plug-in replacement modular design with associated female wiring connector.
2. UL 497B listed and labeled.
3. Multi-stage hybrid protection circuit.
4. Fail short/fail safe.
5. Surge Capacity: 10KA with 8 x 20  $\mu$ s waveform, 500A per line with 10 x 700  $\mu$ s waveform.
6. Clamp Voltage: 150% of circuit peak operating voltage with 100 amp 10 x 700  $\mu$ s waveform.
7. Maximum Continuous Operating Voltage: 125% of peak operating voltage, minimum.
8. Capacitance: 1500 pf.
9. Manufacturer:
  - a) EDCO #PC642C series with #PCBIB base.

B. Addressable Initiation Devices and Data Loops:

1. Plug-in replacement modular design with associated female wiring connector.
2. UL 497B listed and labeled.
3. Multi-stage hybrid protection circuit.
4. Fail short/fail safe.
5. Surge Capacity: 10KA with 8 x 20  $\mu$ s waveform, 500A per line with 10 x 700  $\mu$ s waveform.
6. Clamp Voltage: 150% of circuit peak operating voltage with 100 amp 10 x 700  $\mu$ s waveform.
7. Maximum Continuous Operating Voltage: 125% of peak operating voltage, minimum.
8. Capacitance: 50 pf.
9. Manufacturer:
  - a) EDCO #PC642C-LC series with #PCBIB base.

C. Horn, Strobe, Control Power (Low Voltage):

1. Plug-in replacement modular design with associated female wiring connector.
2. UL 497B listed and labeled.
3. Multi-stage hybrid protection circuit.
4. Fail short/fail safe.
5. Surge Capacity: 5KA with 8 x 20  $\mu$ s waveform.
6. Clamp Voltage: 150% of circuit peak operating voltage with 100 amp 10 x 700  $\mu$ s waveform.
7. Maximum Continuous Operating Voltage: 125% of peak operating voltage, minimum.



8. Series Resistance: 0.2 ohms total per pair.
  9. Manufacturer:
    - a) EDCO #P164 series (1 pair); #P264 series (2 pair), each with #SD12-PC base.
- D. Power Circuit (120 volt):
1. UL 1449 listed.
  2. 15 amp, 120V rated.
  3. Suppressors shall be tested per IEEE, C62.41-1991 for Categories A and B.
  4. Normal mode (L-N), and common mode (L+N-G) protection.
  5. Internal fusing.
  6. Hybrid design.
  7. Indicators for normal operation and failure indication.
  8. Enclosure:
    - a) Fire retardant high impact, phenolic or plastic housing or metal enclosure.
  9. Clamping voltage UL 1449, Line to Neutral, Category B Impulse At (3KA, 8 x 20  $\mu$ 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 UL listing.
  13. Provide additional 15 amp in-line fusing as required to comply with UL and the N.E.C. when connected to a 20 amp, 120V circuit.
  14. Manufacturers:
    - a) Leviton #51020-WM (hardwired).
    - b) EDCO #HSP-121BL2.
- E. Telephone Line Circuits
1. Must be UL 497 listed and labeled for primary protection.
  2. Multi-stage hybrid protection circuit.
  3. Plug-in replaceable modular design or individually mounted units.
  4. Fail short/fail safe.
  5. Surge capacity: 500 amp with 10 x 700 $\mu$ s waveform.
  6. Clamp voltage: 150% of circuit peak operating voltage with 100 amp 10 x 700 $\mu$ s waveform.
  7. Maximum continuous operating voltage: 125% of peak operating voltage, minimum.
  8. Manufacturers:
    - a) EDCO #COHP(FS).
- F. Terminations
1. Provide terminals sized for circuits required on project.

2. Where surge suppression modules are for mounting on 'M' block assembly, provide M block assembly complete with grounding system that mates with surge suppression equipment.

G. Terminal Cabinets

1. Provide terminal cabinets for all terminations and surge suppression equipment including 120VAC power surge suppressor as required in Section 16691. Size terminal cabinets as required to facilitate installation of terminations and surge suppression in a neat and workmanlike manner.
2. Terminal cabinet to meet specifications in Section 16160 unless specifically manufactured for use.
3. Manufacturers:
  - a) Interior.
    1. Square "D"
    2. Hoffman
    3. BUD
  - b) Exterior.
    1. Hoffman
    2. BUD
    3. Carlon

2.20 CABLE

- A. Contractor shall provide and install cable as required by the manufacturer, as specified elsewhere in these specifications, and to provide a complete, fully operational, UL Listed Fire Alarm system.
- B. Fire alarm system cables installed in exterior and/or underground raceways shall comply with the applicable sections of NEC Article 800.

2.21 WATERFLOW DETECTOR

- A. Waterflow switch to be supplied and installed by the mechanical contractor and wired in to Fire Alarm System by systems contractor. Zone as shown on zone schedule.

2.22 SPRINKLER SUPERVISORY SWITCHES

- A. Supervisory Switch to be supplied and installed by mechanical contractor and wired in to Fire Alarm System by systems contractor. Zone as shown on zone schedule.

PART 3- EXECUTION

3.1 INSTALLATION

- A. The contractor is advised that circuit routing for this system is not necessarily shown on the project drawings. The contractor shall provide and install all raceways, wiring and cabling required for a complete and fully functional system as intended by these specifications. All wiring and/or cabling shall be in conduit. Contractor shall provide and install a properly sized, flush mounted outlet box for every device. Contractor shall size and route raceways to accommodate the proper installation of the system cabling. T-Tapped cabling shall not be acceptable. In locations where raceway and/or conduit is not accessible after completion of the project, conduit shall be routed from device to device or fire rated access panels shall be installed to provide access to junction and pull boxes. Routing of raceway from device to device shall only be acceptable where the wiring scheme of the system, as recommended by the manufacturer, requires cable to pass from device to device. Contractor shall properly terminate each device according to the manufacturer's

recommendations. Provide and install firestopping where penetrations are made through rated walls and floors.

- B. Locate, install, and test fire alarm and detection systems in accordance with the equipment manufacturer's written instructions, and the latest editions of the National Electrical Code, the National Electrical Contractor's Association publication "Standard of Installation" and all applicable codes and standards referenced in this specification.
- C. Provide all work required for a complete system including complete system testing and checkout. All components shall be properly mounted and wired. The installation of this system shall comply with the directions and recommendations of authorized factory representatives.
- D. Provide wiring, cabling, raceways, and electrical boxes in accordance with manufacturer's written instructions.
- E. Components shall be electrically "burned-in" by operating the component at full power for a period as recommended by the manufacturer.
- F. Installation shall be done in a neat workmanlike fashion by a firm regularly engaged in Fire Alarm Installation and Service.
- G. The installation and inspection of all fire detection and fire alarm devices and systems shall be performed by, or under the direct on-site supervision of, a licensed fire alarm technician or a fire alarm planning superintendent who shall certify the work upon completion of the activity. The certifying licensee shall be present for the final test prior to certification.
- H. As-built plans and wiring diagrams shall bear the signature and license number of the licensed fire alarm planning superintendent, the date of installation and the name, address, and certificate-of-registration number of the registered firm.
- I. All components shall be completely wired. System shall be fully operable when main power service has failed and the Emergency Standby Generator has assumed emergency system loads. This shall require that any devices which required 120 volt power shall receive supply from an emergency 120 volt source.
- J. Installation of detectors:
  - 1. All ceiling mounted detectors shall be installed in accordance with the requirements of NFPA 72.
  - 2. All concealed detectors shall be provided with a remote indicating lamp and test switch installed in an occupied space (corridor, etc.) on wall or on the ceiling grid indicating the type of detector and the zone to which it is connected. Label shall be red with white lettering.
  - 3. Duct detectors shall be installed in accordance with NFPA 90A. All brackets and hardware shall be provided as required to install detector housing in correct position. All detector housings shall be sealed as required to prevent air leakage between duct and housing. Sampling tubes of proper length shall be provided and installed to match duct width at the installed location.

### 3.2 RACEWAYS AND BOXES

- A. Provide dedicated raceway with applicable boxes for all fire alarm wiring in accordance with applicable sections of these specifications.
- B. All initiating, indicating and auxiliary control devices shall be mounted on UL listed outlet boxes.
- C. Provide supporting devices per Section 16190.
- D. Identify raceways and boxes per Section 16195.

### 3.3 WIRE/CABLE

- A. Conductor: 98% conductivity, solid copper or stranded copper. If stranded conductors are used, then a compression lug shall be 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.
- B. Insulation: A type accepted by NEC for the application. Individual conductors shall be Type THHN/THWN. 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 cable.
  - 2. Notification Appliance Circuits, Devices: AWG #14, THHN/THWN conductors.
  - 3. Initiating Circuits, Hard-Wired Devices: AWG #14, THHN/THWN conductors.
  - 4. Initiating Circuits, Addressable Devices: AWG #14, shielded twisted pair cable.
  - 5. Provide larger conductors where required to maintain voltage drop or signal strength within acceptable limits.
- D. The above wire sizes shall be increased to size as required to comply with authority having jurisdiction or as required for voltage drop, load, etc.
- E. Color Coded:
  - 1. Wiring shall be color coded per Owner's color coding.
  - 2. Permanent wire materials shall be used to identify all splices and terminations for each circuit at all junction boxes, outlet boxes, and terminations.
- F. UL:
  - 1. General: Fire-protective signaling cable shall be UL listed as non-power limited or power limited as needed to match the output of the fire alarm equipment.
  - 2. Non-Power Limited: Fire protective signaling circuits classified as non-power limited shall use cable listed under UL Electrical Construction Materials Directory. Category HNHT, "NON-POWER LIMITED FIRE-PROTECTIVE SIGNALING CABLE". all such cable shall have fire resistance, listing and markings as described in NEC 760.176. Minimum cable marking shall be NPLF.
  - 3. Power Limited: Fire protective signaling circuits classified as power limited shall use cable listed under UL Category HNIR, "POWER LIMITED FIRE-PROTECTIVE SIGNALING CABLE". All such circuits shall be durably marked where plainly visible at terminations to indicate that it is a power-limited fire protective signaling circuit. Refer to paragraph titled "Fire Resistance of Cables" for additional requirements.
  - 4. Fire Resistance of Cables: Power-limited fire-protective signaling circuit cables shall be UL listed as described in NEC 760.179. All such cable shall bear a cable marking that includes a Type designation as given in NEC Table 760.179(I). Provide Type FPL.
- G. Connections of Installation Wiring:
  - 1. Connections to Equipment: In accordance with NFPA for monitoring integrity and with the equipment manufacturer's instructions.
  - 2. Connections of installation wiring to alarm initiating devices and alarm indicating appliances shall be monitored for integrity.
  - 3. Interconnecting means shall be arranged so that a single break or single ground fault will not cause an alarm signal.

4. Apply a compression lug, similar to T&B Sta-Kon Terminal, to all stranded conductors at terminations or use box-lug terminal strips.
5. There shall be no wire splices. All wiring shall be continuous, uncut between devices and terminal blocks.

H. Rated Enclosures:

1. All vertical fire alarm wiring traversing more than one level shall be routed in rated enclosures. In addition, all horizontal wiring serving devices located on floors other than where wiring originates shall be routed in 2-inch concrete encasement, suitable rated building construction, or 2-hour wrap application enclosure accepted by local authority having jurisdiction.

3.4 MANUAL PULL STATIONS

- A. Install at 48 inches to top above finished floor.
- B. All manual stations shall be in unobstructed locations.
- C. Install to comply with NFPA, ADA, and all handicap/accessibility code requirements.
- D. Provide, install, and connect additional pull stations (from that shown on drawings) as required to comply with above requirements.

3.5 AUDIBLE SIGNAL DEVICES, VISUAL SIGNAL DEVICES 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 at heights above the finished floor of not less than 80 inches and no greater than 96 inches.
  2. In general, no place in any room or space required to have a visual signal appliance shall be more than 50 ft. (15 m) from the signal (in the horizontal plane). In large rooms and spaces exceeding 100 ft. (30 m) across, without obstructions 6 ft. (2 m) above the finished floor, such as auditoriums, devices may be placed around the perimeter, spaced a maximum 100 ft. (30 m) apart, in lieu of suspending appliances from the ceiling. Placement of visual devices shall not be less than the requirements as specified by NFPA 72.
  3. No place in common corridors or hallways in which visual alarm signaling appliances are required shall be more than 50 ft. (15 m) from the signal. Placement of visual devices shall not be less than the requirements as specified by NFPA 72.

3.6 END-OF-LINE DEVICE

- A. Mount end-of-line device box with last device or separate box adjacent to last device in circuit.

3.7 AUXILIARY CONTROL RELAYS

- A. An auxiliary fire alarm relay used to control an emergency control device, e.g., motor controller for HVAC system fan or elevator controller shall be located within 3 ft. of the emergency control device.
- B. The installation wiring between the system panel and the auxiliary fire alarm relay shall be monitored for integrity.
- C. Auxiliary control relays shall be listed for use with fire alarm systems.

3.8 SPRINKLER FLOW SWITCHES

- A. Coordinate the electrical and operating characteristics of the flow switches with the fire alarm panel.
- B. Run conduit and wiring to the flow switches, and connect them so as to provide an operable supervised sprinkler alarm system per NFPA standards, and state and local codes.
- C. Provide all electrical including zones as required by authority having jurisdiction and codes.

### 3.9 SPRINKLER VALVE SUPERVISORY SWITCHES

- A. Coordinate the electrical and operating characteristics of the supervisory switches with the fire alarm panel.
- B. Run conduit and wiring to the supervisory switches, and connect them so as to provide an operable supervised sprinkler alarm system per NFPA standards, and state and local codes.
- C. Provide all electrical including zones as required by authority having jurisdiction and codes.

### 3.10 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.

### 3.11 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 TELEPHONE TIE

- A. Provide new conduit/wire from FACP and terminal cabinet to main telephone board. Connect as directed by owner/telephone company. Provide and install dialer with surge suppression on telephone line.

### 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 by contractor to assure a properly surge protected system.
  - 3. Surge protection equipment must be selected by contractor to match the equipment being protected including wire sizes, operating volts, amps, and circuit impedance.
  - 4. Installation of surge protection equipment and its grounding must be per manufacturer's recommendations to assure short and proper ground paths.
- B. Equipment Selection
  - 1. Contractor to coordinate with suppliers and installers of all equipment being protected and provide surge suppression equipment which meets these specifications on respective equipment, wires, etc.
- C. Equipment Installation
  - 1. Install surge suppression equipment per 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.

3. Locate surge suppression equipment in terminal cabinet nearest main equipment cabinet (FACP).
4. Coordinate with Section 16691 contractor to assure that surge suppression for 120VAC power circuit and surge suppression required by this section are all installed in same terminal cabinet and bonded together.

D. Ground Installation

1. Ground Bus Connections.
  - a) Provide "local" ground bus in each terminal cabinet housing surge protection equipment (with lugs, etc. as required).
  - b) Bond "local" ground bus to terminal cabinet with minimum #6 copper wire.
  - c) Connect terminal cabinet "local" ground bus to "systems" ground bus installed per 16170 with minimum #6 copper insulated wire (unless otherwise noted) in conduit.
  - d) Note that "systems" ground bar is also to be used for power transformation ground (480V to 208V) where applicable.
2. Surge suppression equipment grounding.
  - a) Connect each surge suppressor to local ground bus in terminal cabinet with wire sized as recommended by manufacturer. Where "M" block type terminations/surge suppressors are used, bond ground rail to local ground bar with wire as recommended by manufacturer.
  - b) Coordinate with Section 16691 contractor to assure that 120VAC power source/supply surge suppressor is also grounded to same local ground bus as surge suppressors provided in this section for same system (i.e. fire alarm, intercom, television, etc.).
3. Conductors.
  - a) Conductors shall meet requirements of Section 16123. Minimum size to be #12 THWN.
  - b) Bends in excess of 90 degrees in any grounding conductor shall not be permitted. A radius of 6 inches or greater shall be maintained on all bends.
  - c) Do not bundle unprotected conductors with protected conductors.
  - d) Conductors shall be kept as short as possible.
  - e) Conductors shall be secured at 12" intervals with an accepted copper clamp.
  - f) Grounding conductors shall be properly connected to the building service ground by accepted clamps.
4. Grounding Connectors
  - a) Connectors, splicers, and other fittings used to interconnect grounding conductors, bond to equipment or grounding bars, shall be accepted by NEC or UL for the purpose.
  - 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. Where the modem or coupling device is furnished by the telephone company the suppressors shall be installed on the system side of the modem or coupling device.
  2. Where the modem or coupling device is furnished by the system contractor, the suppressor shall be installed on the telephone line side of the modem or coupling device.

3.14 CONDUIT/BOX IDENTIFICATION

- A. Contractor shall identify fire alarm conduit and boxes with red paint in exposed locations. Identify conduit in concealed locations with 4" mark of red paint every 4'-0" 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 the contractor shall accomplish a complete test of the fire alarm system in accordance with NFPA 72, Test Methods.
- B. Perform a complete, functional, component by component test of the entire fire alarm and detection system. Provide a detailed step by step testing procedure which is unique to this project, reflecting the type of system and the number and location of all components.
- C. Demonstrate the proper operation of each component as follows:
  1. Ionization, 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.
- D. 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 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.

### 3.19 AUTHORITY HAVING JURISDICTION

- A. The drawings and specifications herein comply to the best of the engineer's knowledge with all applicable codes at time of design. However, it is this contractor's responsibility to coordinate/verify (prior to bid) the requirements of the authority having jurisdiction over this project and bring any discrepancies to the engineer's attention at least seven days prior to bid. No changes in contract cost will be acceptable after the bid for work/equipment required to comply with the authority having jurisdiction.

END OF SECTION

SECTION 16742 - PREMISE DISTRIBUTION SYSTEM (EMPTY RACEWAY)

PART 1 - GENERAL

1.1 GENERAL

- A. Applicable provisions of applicable sections of Division 16, General Conditions, Supplementary General Conditions, General Requirements, and Division 1, govern work under this Section.
- B. The work described herein and on the drawings consists of all labor, materials, equipment, and services necessary and required to provide and install a Premise Distribution Empty Raceway 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.
- C. The drawings and specifications herein comply to the best of the engineer's knowledge with all applicable codes at the time of design. However, it is this Contractor's responsibility to coordinate/verify (prior to bid) the requirements of the authority having jurisdiction over this project and bring any discrepancies to the engineer's attention at least seven (7) days prior to bid. No changes in contract cost will be acceptable, after the bid, for work and/or equipment required to comply with the authority having jurisdiction.
- D. The Contractor is advised that circuit routing for this system is not necessarily shown on the project drawings. The contractor shall provide and install all raceways required for a complete and fully functional system as intended by these specifications. The Contractor shall provide and install a properly sized, flush mounted outlet box for every device. Contractor shall provide and install, within the wall, a properly sized conduit extended above ceiling and turned into room it serves for each device. Contractor shall size and route raceways to accommodate the proper installation of the system cabling. In locations where raceway and/or conduit is not accessible after completion of the project, conduit shall be routed from the device to an accessible area. Routing of raceway from device to device shall not be acceptable. Contractor shall properly terminate each device according to the manufacturer's recommendations. Provide and install sleeves and firestopping where penetrations are made through rated walls and floors.

1.2 DESCRIPTION OF SYSTEM

- A. The Contractor shall provide a complete empty raceway system for the Premise Distribution System (PDS) to include all equipment, materials, and labor as required to provide, install and test complete a system as described herein. The system to include but not be limited to:
  - 1. Telephone Service Entrance Pathway: Raceway from point of telephone utility connection to building service terminal backboard.
  - 2. Backbone Pathway: Conform to ANSI/EIA/TIA-569 using conduit, cable tray, backboards, etc. as indicated.
  - 3. Horizontal Pathway: Conform to ANSI/EIA/TIA-569-1990, using raceway, bridle rings, sleeves, backboards, and cabinets as indicated.
  - 4. Raceways, outlet boxes, cabinets, identification, etc.: Conform to applicable sections in these specifications. Provide/install complete with all required basic materials.
  - 5. Terminal backboards and/or cabinets.
  - 6. Fireproofing.
- B. Special Requirements for Cable Routing and Installation:
  - 1. Sealing of openings between floors, through rated fire and smoke walls, existing or created by this contractor for cable pass through shall be the responsibility of the Contractor. Sealing material and application of this material shall be accomplished in such a manner which is acceptable to the local fire and building authorities having jurisdiction over this work. Creation of such openings as are necessary for raceway

passage between locations as shown on the drawings shall be the responsibility of the Contractor. Any openings created by or for this Contractor and left unused shall also be sealed as part of this work.

2. The Contractor shall be responsible for any damage to any surfaces or work disrupted as a result of his work. Repair of surfaces, including painting, shall be included as necessary.
- C. All future backbone cable shall be installed in appropriate raceway system.

### 1.3 STANDARDS, CODES, REFERENCES, AND REGULATORY REQUIREMENTS

- A. Reference Section 16014.
- B. All referenced Standards, Codes, and Regulatory Requirements shall be either the latest version adopted by the Authority Having Jurisdiction or, where not formally adopted, the latest published version.
- C. The equipment and installation shall comply with the current or applicable provisions of the following standards:
  1. American Society for Testing and Materials (ASTM)
  2. ANSI/TIA/EIA-568-A - Commercial Building Telecommunications Cabling Standard.
  3. ANSI/EIA/TIA-569 - Commercial Building Standard for Telecommunication Pathways and Spaces.
  4. ANSI/TIA/EIA-606 - Administration Standard for The Telecommunications Infrastructure of Commercial Buildings.
  5. ANSI/TIA/EIA-607 - Commercial Building Grounding and Bonding Requirements for Telecommunications.
  6. ANSI/EIA/TIA-492-AAAA - Detail Specification for 62.5 Micrometer Core Diameter/125 Micrometer Cladding Diameter Class 1a Multimode, Graded Index Optical Waveguide Fibers.
  7. ANSI/EIA/TIA-TSB-67 - Transmission Performance Specifications for Field Testing of Unshielded Twisted-Pair Cabling Systems.
  8. FCC: Federal Communication Commission Part 68 as modified by Wiring Docket 88-57.
  9. BICSI TDMM - Building Industry Consulting Service International, Inc. Telecommunications Distribution Methods Manual
  10. Florida DMS/DOC - General Facility Requirements for Telecommunications Systems.
  11. LPC - Lightning Protection Code (NFPA-780).
  12. NEC - National Electrical Code (NFPA-70).
  13. NFPA 262 - National Fire Prevention Association.
  14. IEEE 802.3 - Institute of Electrical and Electronics Engineers LAN Standard for Ethernet.
  15. IEEE 802.5 - Institute of Electrical and Electronics Engineers LAN Standard for Token Ring.
  16. UL Listed - Underwriters Laboratories Listed.
  17. UL Certified - UL's LAN Cable Certification Program.
  18. UL 910 - Test for Flame Propagation and Smoke Density Values for Electrical and Optical Fiber Cables Used in Spaces Transporting Environmental Air.
  19. UL 1666 - Test for Flame Propagation Height of Electrical and Optical Fiber Cables Installed Vertically in Shafts.

20. UL 1449 3rd Edition - Standard for Safety for Surge Protective Devices.
21. UL 497, UL 497A, UL 497B.
22. ANSI - American National Standards Institute.
23. NEMA - National Electrical Manufacturer's Association.
- D. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and indicated.
- E. The equipment and installation shall comply with the current or applicable provisions of the following codes and laws:
  1. Americans with Disabilities Act (ADA): Where applicable, the Premise Distribution System shall comply with:
    - a) ADA, Public Law 101-336, 1990.
    - b) 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. Local and State Building Codes.
    - a) Florida Building Code
    - b) Florida Administrative Code
    - c) Department of Community Affairs Florida Board of Building Codes and Standards - Florida Accessibility Code For Building Construction
  4. Authority Having Jurisdiction:
    - a) General: The system shall comply with all applicable Codes, Ordinances and Standards as interpreted and enforced by the local authority having jurisdiction.

#### 1.4 RELATED SECTIONS

- A. All applicable sections of Division 0, Division 1, and Division 16.

#### 1.5 QUALITY ASSURANCE

- A. Manufacturer: Company specializing in manufacturing the products specified in this section with minimum 5 years documented experience.
- B. Supplier: Authorized distributor of specified manufacturer with minimum 5 years documented experience.
- C. Installer:
  1. The Contractor shall be experienced in all aspects of this work and shall be required to demonstrate direct experience on recent systems of similar type and size. The Contractor shall own and maintain tools and equipment necessary for successful installation and testing of optical and metallic premise distribution systems and have personnel who are adequately trained in the use of such tools and equipment.
  2. Contractor shall specialize in installing raceway systems for Premise Distribution Systems with minimum five (5) years documented experience.
  3. The Contractor shall be a direct sales division of, or the authorized and designated distributor for the equipment manufacturer whose product he intends to install.
  4. The Installer shall be currently licensed as a Certified Limited Energy System Specialty Contractor (ES 069).
  5. Installing Contractor shall maintain a permanent, local staff of specialists, including a Superintendent, for planning, installation, and service.

6. 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 Premise Distribution Systems for at least five (5) consecutive years going back from date of bid.
  7. A resume of qualification shall be submitted with the Contractor's proposal indicating the following:
    - a) A list of recently completed PDS projects of similar type and size with contact names and telephone numbers for each.
    - b) A technical resume of experience for the Contractor's on-site Installation Foreman who will be assigned to this project.
    - c) Similar documentation for any sub-contractor who will assist the Contractor in performance of this work.
  8. Perform work governed by local telephone utility (service entrance only) in accordance with telephone utility's rules and regulations.
- D. To establish the type and operating characteristics of the Premise Distribution System, the equipment specified herein is used as a guide in determining the functions of the system. Other equipment will be considered for acceptance provided the following is submitted in writing by the system installer to the engineer (See Section 16010 on Substitutions):
1. Contractor qualifications (as listed above).
  2. Complete lists, descriptions and drawings of materials to be used.
  3. A complete narrative outlining the differences between the specified product and the contractor's proposed substitution product.
  4. A complete riser diagram of Premise Distribution System.
  5. Where the Contractor proposes to substitute the specified cable (either copper or fiber optic) he shall provide to the engineer a complete copy of the U.L. Test report for that product. Proposed cable substitutions that are not accompanied by the appropriate U.L. test report will be rejected.

#### 1.6 SUBMITTALS

- A. Submit in accordance with Sections 16010 and 16012.
- B. In addition to requirements of 16010 and 16012, the contractor shall submit:
  1. Narrative of operation of System as provided. (Submittal will not be reviewed by the A/E without this narrative.)
  2. Manufacturer's data on all products, including but not limited to:
    - a) Catalog cut sheets.
    - b) Roughing-in diagrams.
    - c) Installation instructions. Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of product.
    - d) Operation and maintenance manuals.
    - e) The Contractor shall submit test reports, manufacturers' specifications and any other information necessary to determine compliance with material and equipment specifications described herein.
    - f) Qualifications: Submit qualifications of system installer including but not limited to:

- g) Contractor's license.
- h) Proof of certification by the manufacturer(s).
- i) Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- j) Submit labeling scheme and sample of label.
- k) Contractor shall submit test reports, manufacturer's specification sheets and any other information necessary to determine compliance with material and equipment specifications described herein.
- l) Submit a detailed step by step testing procedure for a component by component system functional checkout and test.

#### 1.7 PROJECT RECORD DOCUMENTS

- A. Submit in accordance with Sections 16010 and 16098.
- B. In addition to the requirements of 16010 and 16098, the contractor shall submit:
  - 1. Record actual locations and sizes of pathways, terminal boards, etc.
  - 2. Record "to and from" locations for all raceways at each terminal board or cabinet.
  - 3. Provide detailed documentation of the distribution system to facilitate system administration, system maintenance and future system changes. This requirement includes as-built drawings, a bill of materials of all installed equipment and wiring, rack and backboard equipment layouts showing placement of support equipment, and model and serial numbers of all installed equipment (cables, connectors, outlets, equipment). A clear and consistent nomenclature scheme is to be defined and used on the documentation.
  - 4. Drawings required herein are in addition to those required under "OPERATION AND MAINTENANCE DATA".

#### 1.8 OPERATION AND MAINTENANCE DATA

- A. Submit in accordance with Sections 16010 and 16098.
- B. In addition to the requirements of 16010 and 16098, the contractor's O & M Manuals shall include:
  - 1. A complete as-installed equipment list, listed by room, with manufacturers' names, model numbers, serial numbers, and quantities of each item.
  - 2. A complete and correct system schematic, showing detailed connections for all parts of the system. System performance measurements shall be documented as noted elsewhere in this specification.
  - 3. Riser diagrams showing as-installed conduit with pull boxes, outlet boxes, etc..
  - 4. Drawings required herein are in addition to those required under "PROJECT RECORD DOCUMENTS".

#### 1.9 WARRANTY

- A. The contractor shall warrant the equipment to be new and free from defects in material and workmanship, and will, within one year from date of acceptance by owner, repair or replace any equipment found to be defective.
- B. No charges shall be made by the installer for any labor, equipment, or transportation during this period to maintain functions.
- C. Respond to trouble call within twenty-four (24) hours after receipt of such a call.

- D. The contractor shall guarantee all raceways to be free from inherent mechanical or electrical defects for one (1) year from date of final acceptance of the system.

#### 1.10 DEFINITIONS

- A. **Horizontal Pathways.** Horizontal pathways are facilities for the installation of communication cable from the communications closet to the work area communications outlet. Horizontal pathways encompass underfloor, accessfloor, conduit, tray and wireway, ceiling, sleeves, perimeter facilities and applicable fireproofing.
- B. **Backbone Pathways.** Backbone pathways consist of intrabuilding and interbuilding pathways. The term backbone replaces rise, house, and building-tie cable terminology. Backbone pathways may be either vertical or horizontal. Interbuilding backbone pathways extend between buildings. Intrabuilding backbone pathways are contained within a building.
- C. **Intrabuilding pathways** consist of conduit, sleeves or slots, and trays, and provide the means for placing backbone cables from:
  - 1. CER to CC
  - 2. CC or CP to CC or CP

#### PART 2 PRODUCTS

##### 2.1 GENERAL EQUIPMENT AND MATERIAL REQUIREMENTS

- A. All equipment shall be new and unused. All components and systems shall be designed for uninterrupted duty. All equipment, materials, accessories, devices, and other facilities covered by this specification or noted on the contract drawings shall be the best suited for the intended use and shall be provided by a single manufacturer.
- B. Provide all components, equipment, parts, accessories and associated quantities required for complete installations. All components may not be specified herein.
- C. All devices/components/products shall be suitable for use intended, and meet all stated performance requirements for PDS configurations specified in this section.

##### 2.2 RACEWAYS

- A. **General:**
  - 1. All pathways (conduit, raceways, wireways, pullboxes, outlet boxes, etc.) shall comply with applicable requirements of sections within Division 16 of these specifications.
  - 2. All pathways (conduit, raceways, wireways, pull boxes, outlet boxes, etc.) shall comply with all requirements of ANSI/EIA/TIA-569.
  - 3. Conduit. (Comply with Section 16111 except as noted below).
  - 4. Metal flexible conduit shall not be used for PDS system.
  - 5. Bushings: Provide insulated bushings on ends of all raceway. All backbone conduits shall have bonding bushings and be bonded to the Systems Ground Bus Bar with an insulated #6 AWG wire.
  - 6. Pull Cords: Install pull cords in all raceway runs that are installed without cable.
  - 7. Size:
    - a) See Part 3 for size requirements.
    - b) Minimum size shall be 1".
  - 8. Boxes:
    - a) All outlet boxes, junction boxes, pull boxes, etc. shall comply with applicable section of these specifications.

- b) Boxes shall be sized as required by EIA/TIA and NEC for cables, conduit and/or device installed.

### 2.3 TERMINATION BACKBOARDS

- A. Material: 3/4" A/C grade, Class A fire retardant plywood.
- B. Size: 8 ft. high with width as shown on drawings unless otherwise noted or required in these specifications.
- C. Finish: Paint terminal board with gray paint having a flame spread rating of Class A as a minimum.

### 2.4 TERMINATION CABINETS

- A. Terminal cabinets are to comply with applicable sections of these specifications.

### 2.5 "SYSTEMS" AND "LOCAL" GROUND BUS

- A. Bus to comply with applicable sections of these specifications.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

#### A. General

1. The Contractor is advised that circuit routing for this system is not necessarily shown on the project drawings. The Contractor shall provide and install all raceways required for a complete and fully functional system as intended by these specifications. Contractor shall provide and install a properly sized, flush mounted outlet box for every device. Contractor shall provide and install, within the wall, a properly sized conduit extended above ceiling and turned into room it serves for each device. Contractor shall size and route raceways to accommodate the proper installation of the system cabling. In locations where raceway and/or conduit is not accessible after completion of the project, conduit shall be routed from the device to an accessible area. Routing of raceway from device to device shall not be acceptable. Contractor shall properly terminate each device according to the manufacturer's recommendations. Provide and install sleeves and firestopping where penetrations are made through rated walls and floors.
2. Locate, install, and test the Premise Distribution System in accordance with the equipment manufacturer's written instructions, and the latest editions of the National Electrical Code, the National Electrical Contractor's Association publication "Standard of Installation" and all applicable codes and standards referenced in this specification.
3. Install raceways and outlets as required to comply with all applicable requirements of the references and/or regulatory requirements called for under PART 1 of this section of specifications, as a minimum installation requirement. Exceed this minimum requirement when called for herein.
4. Install all electrical basic materials per applicable sections of these specifications.
5. Properly ground system per applicable sections of these specifications.
6. Support raceways, backboards, and cabinets under the provisions of Section 16190, and/or as required by manufacturer's instructions.
7. Install raceways to conform to applicable sections of these specifications.
8. The PDS system contractor shall be responsible for any damage to any surfaces or work disrupted as a result of his work. Repair of surfaces, including painting, shall be included as necessary.

#### B. Outlets:



1. General: Install outlets for PDS where indicated on the drawings. Install devices/inserts in outlets so that same orientation is used throughout project.
  2. Outlets: Install per applicable section of these specifications (i.e., outlet boxes, indoor service poles, floor boxes, etc.).
  3. Wall Plates: Provide and install a blank stainless steel cover plate on each outlet box.
- C. Pathway
1. General
    - a) Provide and install raceway for all drops down walls, to non-exposed location, penetrations of fire rating assemblies/walls/etc., where exposed to damage, exterior locations, underground locations, interconnection of CC's, CP's, and CER's, or any combination thereof, for all backbone cables, and all areas required by applicable codes and standards or as otherwise noted/required in these specifications.
    - b) Where acceptable to authority having jurisdiction and all applicable codes/standards, cables above accessible ceilings may be run without raceways provided complete installation complies with all applicable codes/standards. Proper firestopping and support hardware must be utilized.
    - c) All raceways shall meet the applicable requirements of all Sections 16100 through 16199.
    - d) All raceways at terminal boards shall terminate at point within 6 inches of termination board with appropriate bushing, (ground if metal).
    - e) Raceway shall not be shared by power or any other electrical wiring that is not part of the low voltage PDS systems. PDS system wiring may be installed in underground pull boxes with other low-voltage systems provided:
      1. Installation meets/complies with all applicable codes and standards.
    - f) Bend raceway with minimum inside radius of 6 times the internal diameter. Increase bend radius to 10 times for raceway larger than 2 inch size. Provide proper bend for all changes of direction. Pull and splice boxes shall not be used in lieu of a bend.
    - g) Install raceways so no more than two 90° bends are in any raceway section without pullbox. Install additional pullboxes as required to maintain maximum of two 90° bends between pullboxes and/or termination points.
    - h) Label all raceway at both ends to indicate destination and PDS source room. Also indicate length of raceway and this labeling/identification shall be fully documented in as-built (record) drawings.
    - i) Install polyethylene pulling string in each empty conduit over 10 feet in length or containing a bend.
    - j) Special Raceway Systems: Special raceway systems may be specified for some portions of the PDS system. Refer to the drawings and other sections of these specifications to determine where or if such systems are used.
    - k) Pathways/raceways at terminal board locations shall be neatly racked on a Kindorf type rack secured to wall above and below terminal boards.
- D. Fire Stop
1. Where conduit penetrates a fire rated wall, floor, etc., firestopping shall be provided.
  2. Provide permanent firestopping seals after cable installers have pulled risers and distribution cables.

3. Meet all requirements for UL assembly involved. Provide firestopping UL listed for assembly, conduit, and/or cable involved.
- E. Horizontal Cable Pathway
1. Sleeves
    - a) Install rigid steel conduit sleeves with bushings on both ends at penetration of all walls above ceilings. Stub-out each side of wall a minimum of 12 inches.
    - b) Install firestopping at sleeves and all rated firewall/smoke wall penetrations. Stub-out wall as required for routing. Firestopping assembly must comply with UL for wall routing and material used.
    - c) Size sleeves as required by the NEC for cable installed, but in no case shall sleeve be less than 2 inch diameter, nor smaller than that required by "4)" below.
    - d) Sleeve size shall not be smaller than that required by EIA/TIA-569, Table 4.1-1, "Conduit Sizing."
- F. CC/CER Termination Locations
1. Provide bushings on each end of wireway.
- G. CP Termination Locations
1. Install wireway from CP to ceiling space as called for CC/CER locations, but terminate wireway at CP.
  2. Locations requiring two (2) wall mounted equipment cabinets shall have, as a minimum, two (2) 2" conduits installed between the two assemblies for routing of patch cables. In all cases the Contractor shall size these conduits according to the NEC fill requirements and shall provide patch cables of sufficient length for the routing path.
- H. Communication Outlet (CO) Pathway:
1. Each CO outlet shall have conduit stubbed up above ceiling. Terminate stub in cavity with an "ell" to facilitate cable entry into wall stub.
  2. Minimum size to be 1" c.
- I. Backbone Pathways (Intrabuilding or Interbuilding)
1. Install raceways as required above under "General."
  2. Minimum size: 2" C.
  3. Increase size of conduit/raceway/pathway called for above if larger size is called for on drawings or larger size is required per paragraph "2)" below.
  4. Conduit/raceway/pathway size shall not be smaller than that required by EIA/TIA-569, Table 5.2-1, "Conduit Fill for Backbone Cable." Conduit size shall be based on type of cable and quantity of cables.
- J. Pullboxes, Splice (Junction) Boxes, Outlet Boxes
1. Install per applicable sections of these specifications and all applicable codes/standards.
  2. Boxes shall be placed above accessible ceilings and in an exposed manner and location, and readily accessible. Boxes shall not be placed in a fixed false ceiling space unless immediately above a suitably marked and rated hinged access panel.
  3. A pull or splice box shall be placed in a conduit run where:
    - a) the length is over 100 feet,
    - b) there are more than two 90° bends, or
    - c) if there is a reverse bend in the run.

4. Boxes shall be placed in a straight section of conduit and not used in lieu of a bend. The corresponding conduit ends should be aligned with each other. Conduit fittings shall not be used in place of pull boxes.
  5. Outlet boxes shall be installed at locations shown on drawings per applicable codes/standards.
  6. Provide bushed nipple at speakers receiving cable without raceway/conduit.
  7. Every pullbox and/or splicebox shall have a hinged cover. Install appropriate access panel to allow cover to open.
  8. Size:
    - a) Where a pullbox is required with raceway(s) smaller than 1-1/4 trade size, an outlet box may be used as a pullbox.
    - b) Where a pullbox is used with raceway(s) of 1-1/4 trade size or larger, the pull box shall:
      1. for straight pull through, have a length of at least 8 times the trade size diameter of the largest raceway;
      2. for angle and U pulls:
        - (a) have a distance between each raceway entry inside the box and the opposite wall of the box of at least 6 times the trade size diameter of the largest raceway, this distance being increased by the sum of the trade size diameters of the other raceways on the same wall of the box; and
        - (b) have a distance between the nearest edges of each raceway entry enclosing the same conductor of at least:
          - (1) -six times the trade size diameter of the raceway; or
          - (2) -six times the trade size diameter of the larger raceway if they are of different sizes.
      3. for a raceway entering the wall of a pullbox opposite to a removable cover, have a distance from the wall to the cover of not less than the trade size diameter of the largest raceway plus 6 times the diameter of the largest conductor.
  9. Where a splicebox is used with raceway, it shall be sized per EIA/TIA-569, Table 4.4-2, "Splice Box Sizing."
  10. No box shall be smaller than that required by NEC 314.28(A) (1) and (2).
- K. Telephone System Service Entrance Conduit/Raceway:
1. General:
    - a) Provide an underground telephone service entrance conduit system.
  2. Raceway:
    - a) Provide rigid Schedule 40 PVC conduit except all stub-ups, elbows and changes of direction shall be galvanized rigid steel.
    - b) All bends shall be formed with large sweeping radius.
    - c) Provide nylon pull cord in each raceway.
    - d) Provide insulating bushing at all ends.
    - e) Leave at least 12" of free pull cord and cap all ends.

- f) Provide a pull box whether shown on drawings or not at least every two 90° bends and more as may be required by the telephone company cable installers. Pull boxes shall be dedicated to telephone cables.
  - g) Change of direction shall not exceed 90° per bend.
  - h) Provide suitable raceway mounting anchors or bracing to withstand cable pulling force.
  - i) Terminate and identify service conduit at the property line as directed by the telephone company cable installer.
  - j) For penetration of foundation walls below grade, provide a galvanized rigid conduit sleeve that extends at least 24" outside wall, or longer to reach undisturbed soil, to prevent service conduit shearing by building settlement.
  - k) Telephone service conduit shall be buried with at least 24" of cover.
  - l) When concrete encasement is not provided, bury a continuous orange plastic warning tape above the service conduit, "CAUTION-TELEPHONE LINE BURIED BELOW," or similar accepted wording. Tape shall be TerraTape by Reef Industries or accepted substitution. Tape shall be six inches wide, 6 mil plastic with minimum 600% elongation (extra-stretch).
  - m) Telephone service conduits shall be separated from power conduits by not less than:
    - 1. 3" of concrete or
    - 2. 24" of earth, well-tamped.
- L. Termination Backboards
- 1. Terminal boards shall be installed secure to wall with bottom of board at 6" above floor.
  - 2. Install termination backboards plumb, and attach securely to building wall at each corner.
  - 3. Finish paint termination backboards with durable gray paint having flame spread rating of Class A prior to installation of any equipment on termination boards.
  - 4. Mark all backboards with the legend "PDS" under the provisions of Section 16195.
- M. Grounding
- 1. Provide and install complete grounding system as required to comply with all sections of these specifications and applicable codes.
  - 2. Connect Central Equipment rack to "systems" ground bus with #6 green insulated copper ground wire.
  - 3. Connect metal conduit (via grounding bushing) to "systems" ground bus.
  - 4. Connect cable shields to "systems" ground busbar.
  - 5. Connect surge suppression equipment to "systems" ground busbar.
- N. Terminal Boards
- 1. General:
    - a) Terminal boards shall be installed secure to wall with bottom of board at 6" above floor.
  - 2. Grounding:
    - a) Ground each terminal board by extending 1 AWG #6 green insulated copper conductor in 3/4" non-metallic conduit from a junction box at terminal board to the nearest accessible acceptable building grounding electrode system as defined in

NEC Article 800.100(B). Where "SYSTEMS" grounding bus/bar (see Section 16170) is provided in same room as terminal board, the bus/bar may be used for grounding point if acceptable to telephone system installer and all applicable codes.

- b) Locate junction box where directed by PDS installers.
- c) Coil a minimum 6 ft. length of conductor pigtail and leave inside junction box.

### 3.2 FIELD QUALITY CONTROL

- A. Perform all testing where necessary or specified to assure a fully functional system. Replace and/or repair and retest components that fail performance standards.

### 3.3 DEMONSTRATION

- A. Demonstrate system to designated Owner personnel as required by applicable sections of these specifications.
- B. Conduct walking tour of project. Briefly describe function, operation, and maintenance of each component.
- C. Provide detailed operation and maintenance instruction and training.
- D. Use submitted operation and maintenance manual as reference during demonstration and training.

END OF SECTION 16742

SECTION 16745 - COMPUTER/DATA RACEWAY SYSTEM

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This conduit system including terminal cabinets, backboards, and outlets as shown by the drawings and described herein, shall be furnished and installed by the Electrical Contractor.

PART 2 - PRODUCTS

2.1 GENERAL

- A. This system shall have the same terminal board as the telephone system.
- B. Raceway and outlet boxes shall conform to the requirements outlined in the Raceway Section of this specification. Conduits shall be 3/4" C. minimum unless otherwise noted.
- C. Bushings shall be provided on all computer conduits.
- D. Pull strings shall be nylon and shall be impervious to moisture. Pull strings installed in one inch and smaller conduits shall have a tensile strength of not less than 30 lbs. Pull strings installed in conduits larger than 1" shall have a tensile strength not less than 200 lbs.
- E. Grounding conductors shall be #6 bare copper unless noted otherwise.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. All conduits shall be installed in a manner conforming to the requirements outlined in the Raceway Section of this specification.
- B. Conduits at Terminal Board locations shall be neatly racked on a Kindorf Type rack secured to wall above and below terminal boards.
- C. All conduit and boxes shall be installed as shown on the drawings. Any exceptions to the conduit routing shall be brought to the attention of the engineer before installation.
- D. Install blank plates on all outlets to match plates specified for wiring devices.

END OF SECTION

SECTION 16910 - OCCUPANCY SENSORS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Contractor's work to include all labor, materials, tools, appliances, control hardware, sensors, wire, junction boxes and equipment necessary for and incidental to the delivery, installation and furnishing of a completely operational occupancy sensor lighting control system as described herein.
- B. Contractor/Supplier shall examine all general specification provisions and drawings for related electrical work required as work under Division 16.
- C. The Occupancy Sensor System shall sense the presence of human activity within the desired space and fully control the On/Off function of the lights.
- D. Sensing technologies shall be completely passive meaning that they will not emit any radiation that is known to interfere with certain types of hearing aides, or electronic devices such as electronic white board readers. Acceptable programmable shall be Passive Infrared (PIR), and/or PIR/Microphonic Passive Dual Technology (PDT). Ultrasonic or Microwave based sensing technologies shall not be accepted.
- E. Time Delay settings shall be factory set at 10 minutes, and shall not be field adjusted unless specifically instructed by Engineer. This delay selection is based on lamp life vs. energy savings and sensor performance. Automatic adjustments to this delay period by the sensor shall not be permitted.
- F. In high humidity or cold environments, the sensors must be conformably coated and rated for condensing humidity and -40 degree Fahrenheit (and Celsius) operation.
- G. Installer, in accordance with manufacturer's recommendation, shall determine final sensor location. All sensors shall have non-adjustable factory calibrated sensitivity for maximum performance. Time Delay and Photocell field adjustments shall be provided as needed.
- H. The installer shall be responsible for a complete and functional system in accordance with all applicable local and national codes.

1.3 REGULATORY REQUIREMENTS

- A. Conform to requirements of ANSI/NFPA 70.
- B. Furnish products listed and classified by Underwriters Laboratories as suitable for purpose specified and shown.

1.4 DESIGN REQUIREMENTS

- A. The objective of this section is to ensure the proper installation of the occupancy sensor based lighting control system so that lighting is turned off automatically after reasonable time delay when a room or area is vacated by the last person to occupy said room or area.
- B. The occupancy sensor based lighting control shall accommodate all conditions of space utilization and all irregular work hours and habits.

1.5 EQUIPMENT QUALIFICATION

- A. All components shall be UL listed and offer a five year warranty.

1.6 SUBMITTALS

- A. Shop Drawings:
    - 1. Submit shop drawings showing actual field conditions for this project's installation.
  - B. Product Data:
    - 1. Submit data sheets on sensors, control units and all junction boxes and mounting accessories, including all wiring diagrams (standard).
  - C. Submit manufacturer's installation instructions.
- 1.7 PROJECT RECORD DOCUMENTS
- A. Submit record documents to accurately record actual location of each sensor and control unit.
  - B. Revise diagrams included in Drawings to reflect actual control device connections.
- 1.8 OPERATION AND MAINTENANCE DATA
- A. Submit instructions for operation, use, and adjustment of system.
  - B. Submit recommended preventive maintenance procedures and materials.
  - C. Submit parts list.
- 1.9 APPROVED MANUFACTURER AND SUBSTITUTIONS
- A. Approved manufacturer shall be Sensor Switch, Inc. (800) 727-7483 [www.sensorswitch.com](http://www.sensorswitch.com).
  - B. Substitutions must be submitted no less than 14 days prior to bid date. An AutoCAD drawing of the facility showing coverage patterns and technical data must be provided with substitution request. All substitutions must clearly identify any and all exceptions to the specifications with a detailed explanation as to the exception. If substitution is approved, the Contractor shall bear the responsibility of a fully functional system to the Owner's and Engineer's satisfaction.
  - C. Product must be manufactured in the USA and be warranted for five years.
- 1.10 WARRANTY
- A. Contractor shall warrant all equipment furnished in accordance with this Specification to be undamaged, free of defects in materials and workmanship, and in conformance with the specifications.
  - B. The supplier's obligation shall include repair or replacement and testing of all parts of equipment found to be damaged, defective or non-conforming and returned to the supplier. This shall be at no cost to the Owner.
  - C. Warranty on sensor and control units will be for a period of five years.
  - D. The warranty shall commence upon the Owner's acceptance of the project.
  - E. Warranty on labor shall be for a minimum period of one year.
- 1.11 INSTRUCTION TO OWNER
- A. The Contractor shall provide, at the Owner's facility, the training necessary to familiarize the Owner's personnel with the operation, use, adjustment, and problem solving diagnosis of the occupancy sensing devices and systems.

## PART 2 - PRODUCTS

### 2.1 WALL SWITCH SENSORS – SMALL AREAS

- A. Sensor shall recess into single gang switch box and fit a standard Decora opening.
- B. Sensor must meet NEC grounding requirements by providing a dedicated ground connection and grounding to mounting strap. Line and load wire connections shall be interchangeable.



Sensor shall not allow current to pass to the load when sensor is in the unoccupied (Off) condition.

- C. Sensor shall use PIR sensing incorporating a nominal 1/2" focal length lens viewing 9" above and below horizontal view pattern measured at 10'.
- D. Sensor shall have optional features for photocell/daylight override, vandal resistant lens, and no switch as specified.
- E. In areas with inboard/outboard switching, sensor shall provide two dedicated relays and override switches. Each relay shall have independent programmable time delays.
- F. In areas with obstructions to the occupant's workspace, sensor shall utilize programmable dual technology PIR/Microphonic sensing.
- G. All models shall have "Reduced Turn On." This is a field programmable function for problematic areas with unforeseen reflective surfaces. False turn on shall be eliminated with this feature.
- H. Sensor shall be the following Sensor Switch model numbers. Device color and optional features as specified herein or shown on Drawings.
  - 1. WSD (PIR)
  - 2. WSD-2P (PIR inboard/outboard)
  - 3. WSD-PDT (PIR/Microphonic)
  - 4. WSD-PDT-2P (PIR/Microphonic inboard/outboard)
  - 5. WSD-SA (PIR Semi-Automatic)
  - 6. WSD-PDT-SA (PIR/Microphonic Semi-Automatic)

## 2.2 WALL SWITCH SENSORS – LARGE AREAS

- A. Sensor shall surface mount to single gang switch box.
- B. Sensor shall use PIR sensing incorporating a nominal 1" focal length lens viewing 9" above and below horizontal view pattern measured at 20'.
- C. Sensor shall have optional feature for photocell/daylight override.
- D. In areas with inboard/outboard switching or two circuits, sensor shall provide two dedicated relays and override switches.
- E. In areas with obstructions to the occupant's workspace, sensor shall utilize dual technology PIR/Microphonic sensing.
- F. Sensor shall be the following Sensor Switch model numbers. Device color and optional features as specified.
  - 1. LWS (PIR)
  - 2. LWS-2P (PIR inboard/outboard or two circuits)
  - 3. LWS-PDT (PIR/Microphonic)
  - 4. LWS-PDT-2P (PIR/Microphonic inboard/outboard or two circuits)

## 2.3 LOW VOLTAGE SENSORS

- A. Sensors shall operate on a Class 2, three-conductor system. Sensors shall operate on 12 to 24 VAC or VDC and consume no more than 5 milliamps so that up to 14 sensors may be connected to a single power pack.

- B. Upon initial power up, sensors must immediately turn on. Power packs may be wired on the line or load side of local switching and must not exhibit any delays when switch is energized.
- C. In areas with clear line of site view of the workspace, sensors shall use PIR detection. In areas with obstructions, sensors shall use PIR/Microphonic detection.
- D. Specific sensors shall have optional feature for photocell/daylight override, and/or Low Temperature/High Humidity environments.
- E. Sensors shall be the following Sensor Switch model numbers.
  - 1. CM-9 (PIR Ceiling)
  - 2. CM-PDT (PIR/Microphonic Ceiling)
  - 3. CM-10 (PIR Ceiling-Extended Range)
  - 4. CM-PDT-10 (PIR/Microphonic Ceiling-Extended Range)
  - 5. WV-PDT (PIR/Microphonic Wall Mount)
  - 6. HW-13 (PIR Hallway)
  - 7. HM-10 (PIR High Bay Aisle Way)
  - 8. CM-6 (PIR High Bay)

#### 2.4 POWER PACKS

- A. Power packs shall accept 120 or 277 VAC, be plenum rated, and provide Class 2 power for up to 14 remote sensors.
- B. Power pack shall securely mount to junction location through a threaded 1/2" chase nipple. Plastic clips into junction box shall not be accepted. All Class 1 wiring shall pass through chase nipple into adjacent junction box without any exposure of wire leads. Note: UL Listing under Energy Management or Industrial Control Equipment automatically meets this requirement, whereas Appliance Control Listing does not meet this safety requirement.
- C. When required by local code, power pack must install inside standard electrical enclosure and provide UL recognized support to junction box. All Class 1 wiring is to pass through chase nipple into adjacent junction box without any exposure of wire leads.
- D. Power pack shall incorporate a Class 1 relay and an ac electronic switching device. The ac electronic switching device shall make and break the load, while the relay shall carry the current in the "On" condition. This system shall provide full 20 amp switching of all load types, and be rated for 400,000 cycles.
- E. Power packs shall be single circuit, or two circuits. Slave packs may be used to control additional circuits. When two circuit power packs, or slave packs are used, the power packs must be wired directly to circuit breaker. Otherwise, power packs may be wired on the line or load side of the local switch.
- F. Power packs shall be the following Sensor Switch model numbers.
  - 1. PP-20 (Single Pole)
  - 2. PP-20-2P (Two Pole)
  - 3. SP-20 (Slave Pack)

#### 2.5 LINE VOLTAGE SENSORS

- A. Sensors shall be self-contained and accept Class 1 wiring directly without the use of a power pack.

- B. In areas with clear line of site view of the workspace, sensors shall use PIR detection. In areas with obstructions, sensors shall use PIR/Microphonic detection.
- C. Multiple sensors controlling the same load shall be wired in parallel.
- D. Wall mounted sensors must be installed at 7' to 8' above the floor. Single and two circuit units shall be available.
- E. High bay sensors controlling HID Bi-Level must incorporate a Start to High timer on initial power up to provide full light output for up to 20 minutes to prevent shortened lamp life.
- F. Specific sensors shall have optional feature for Low Temperature/High Humidity environments.
- G. Sensors shall be the following Sensor Switch model numbers.
  - 1. CMR-9 & CMR-9-2P (PIR Ceiling Mount- single and two pole)
  - 2. CMR-PDT & CMR-PDT-2P (PIR/Microphonic Ceiling Mount- single and two pole)
  - 3. CMR-10 & CMR-10-2P (PIR Ceiling Mount Extended Range - single and two pole)
  - 4. CMR-PDT-10 & CMR-PDT-10-2P (PIR/Microphonic Ceiling Mount Extended Range - single and two pole)
  - 5. WVR-16 & WVR-16-2P (PIR Wall Mount single and two pole)
  - 6. WVR-PDT & WVR-PDT-2P (PIR/Microphonic Wall Mount single and two pole)
  - 7. HMR-10 (PIR High Bay Aisle Way)
  - 8. CMR-6 & CMR-6-SH (High Bay Ceiling)

## 2.6 WIRING

- A. Between sensors and controls, units shall be a minimum three conductors, 18 AWG, stranded UL Classified, PVC insulated or TEFLON jacketed cable accepted for use in plenums.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Install devices and equipment in accordance with manufacturer's instructions.
- B. It shall be the Contractor's responsibility with the supplier's assistance to locate and aim sensory in the correct location required for complete and proper volumetric coverage within the range of coverage(s) of controlled areas.
- C. Rooms shall have ninety to one hundred percent coverage to completely cover the controlled area to accommodate all occupancy habits of single or multiple occupants at any location within in the room(s).
- D. The locations and quantities of sensors shown on the Drawings are diagrammatic and indicate only rooms which are to be provided with sensors.
- E. The Contractor shall provide additional sensors if required to properly and completely cover the respective room.
- F. Proper judgment must be exercised in executing the work so as to ensure the best possible installation in the available space and to overcome local difficulties due to space limitations or interference of structural components

END OF SECTION