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WATER TREATMENT PLANT
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SUMMARY OF WORK

PART 1 - GENERAL

1.01 SECTION INCLUDES

General description of the Work required under this Contract.

1.02 WORK COVERED BY CONTRACT DOCUMENTS

A. Work of this Contract comprises construction of a new water treatment facility at Port of the Islands Florida. The Contractor shall refer to the Contract Documents for a more complete description of the Work.

B. The Work can be summarized to include furnishing labor, materials, equipment, services, incidentals for the following items:

1. Permits and Approvals
   a. Obtain all building permits, dewatering permits and stormwater pollution prevention plan permit as required by regulatory agencies.
   b. Obtain all other permits necessary for the successful prosecution of the Work.
   c. Obtain the Certificates of Occupancy for the new water treatment building from Collier County and the local Fire District.

2. Demolition
   a. After successful testing and start-up of the entire new water treatment plant including instrumentation and after receipt of DEP approval to place the plant into operation and after 30 days of continuous successful operation of the new water treatment plant and associated facilities, demolish the existing water treatment plant, piping, equipment and structures as noted on the Contract Drawings.
   b. As appropriate to maintain service and treatment and as required by progress of the Work, demolish existing yard piping, duct banks and associated features as noted on the Contract Drawings.

3. Modifications to Existing Facilities
   a. Modify and test the existing electrical equipment rack located south of the existing steel building at the wastewater treatment plant.
   b. Modify the existing masonry building in the existing water treatment plant and provide roof hatch replacements and associated roofing repairs.
   c. Modify, relocate and test existing electrical equipment as shown on the Contract Drawings.
   d. Provide relocated LCEC electrical feed to the existing water treatment plant. Provide relocated fiber optic cable and duct to the existing water treatment plant. This work shall be completed before commencing work on the new water treatment plant building.
4. Coordination with Owner Furnished Equipment  
a. The Owner is providing the following equipment for unloading, storage and installation by the Contractor:  
i. Motor control center that will include VFD units for the following: booster pumps, skid feed pumps, transfer pumps, and high service pumps.  
ii. Transfer pumps.  
iii. High service pumps and pump cans.  
iv. Booster pumps.  
v. Dual strainer skid with skid-mounted piping, valves and backwash control panel.  
vi. Calcite contactor assembly with three contractors and associated piping and valves.  

vii. All field instruments for pH, ORP, chlorine residual, pressure and flow including associated local display, panels and transmitters unless specifically noted in the Contract Drawings.  
b. The Owner is providing the following equipment for unloading, storage and installation by others:  
i. Two membrane treatment skids including filters, control panels (each with a PLC), skid mounted instruments and all wiring and sample piping that are skid mounted.  
ii. Membrane cleaning system including pump skid.  
iii. Chemical feed pumps, chemical flowmeters and drum safety pallets for anti-scalant, sodium hydroxide, sodium hypochlorite and ammonia.  
c. Refer to the Contract Drawings for additional information and requirements associated with Owner Furnished Equipment.  
d. The O&M manuals for Owner furnished equipment shall be provided by others and incorporated into the Facility O&M Manual prepared by the Contractor as specified in Section 01850.  
e. The Contractor shall be responsible for the anchor bolts and securing devices associated with all equipment being furnished by the Owner. All anchor bolts and securing devices shall be Type 316 stainless steel in size and quantity as required by the equipment.  
f. Termination of power and control wiring for and to the Owner furnished equipment shall be provided by the Contractor under the direct supervision of a field representative associated with the equipment.  
g. Start-up and testing assistance for Owner furnished equipment shall be provided by the Contractor as required. Refer to text later in this Section for additional information and requirements.  
h. Start-up and testing assistance for complete water treatment plant shall be provided by the Contractor as required. Refer to text later in this Section for additional information and requirements.  

5. Yard Piping and Civil Work  
a. Excavation of unsuitable material.  
b. Structural and general site fill and grading.
c. Yard piping, valving, backflow preventers, and piping appurtenances including multiple piping tie-ins and connections to existing in-service piping.
d. Storm drainage systems including retention ponds.
e. Paving, parking bumpers, pavement markings and signage.
f. Fencing, gates and gate operators.
g. Site lighting.

6. New Water Treatment Plant
a. Construction of complete structural concrete and masonry building including roofing system, architectural equipment and features and finishes, special acoustical construction and features, pipe trenches and grating system, plumbing system and fixtures, electrical system, lighting system and fixtures, grounding, lightning protection, monorail with hoist, air compressor with appurtenances, fire sprinkler and alarm system, HVAC and painting.
b. Trench piping and all water treatment piping and valves.
c. Construction of high service pump station with pumps, pump cans, piping and valves, concrete work and associated electrical and instrumentation.
d. Construction of reinforced concrete chlorine contact tank with transfer pumps, piping and valves.
e. Construction of packaged sanitary grinder pump station including pumps, concrete work, piping and valves, valve vault, controls, instrumentation and control panel.
f. Construction of RO wastewater holding tank and pump station including concrete work, pumps, piping and valves, valve vault, controls, and control panel.
g. Start-up and testing assistance for Contractor furnished equipment.
h. O&M manuals for Contractor furnished equipment and Facility O&M Manual for entire new water treatment plant that will include O&M sections provided by others for Owner furnished equipment.
i. Completion of all Owner Directed Work, which may or may not be directed during the course of the project.

7. Electrical Systems
a. Underground and above ground wiring systems including conduit and conduit specials, concrete, wiring terminations, panels, termination cabinets and boxes, switches, safety devices, and all appurtenances needed for a complete wiring system for the new water treatment plant and as shown on the Contract Drawings.
b. Modifications to the existing the existing electrical equipment rack as noted above.
c. Transformers, circuit breakers, timers, disconnects, power and distribution panels, switches, surge protection, grounding, lightning protection, safety equipment, and appurtenances, all as may be required for a complete power management system.
d. Arc-flash studies and labels, system-wide coordination study, infrared test of all major power centers, and all other testing as required by the Contract Documents and regulatory agencies.
e. Lights, light fixtures, lighting wire and conduit, and light controls.

f. Fire alarm system.

g. Refer to Section 01120 regarding work sequence for electrical work.

8. Instrumentation and SCADA Systems

a. Furnish and install all level sensors, transmitters and switches unless specifically noted in the Contract Documents to be by others.

b. Furnish and install all control conduit, wiring and termination as described in the Contract Documents.

c. Refer to the Contract Drawings for additional information and requirements regarding Owner Furnished Equipment and the instrumentation and the SCADA system.

1.03 SPECIAL EXPERIENCE REQUIREMENTS

A. The Owner requires certain experience qualifications. The Contractor and the proposed project key personnel must have prior experience on similar projects. Refer to the Bid Proposal for additional information and requirements. Failure of a bidder to document such qualifications may result in rejection of that bid.

B. Refer to Section 16000 for information and requirements related to requirements and qualifications of electrical subcontractors. Electrical subcontractors who are not identified in Section 16000 must be pre-qualified by submittal of specified information at least 14 days prior to bid opening date.

1.04 PLACEMENT OF CONSTRUCTION CRANES AND LIFTING EQUIPMENT

A. As may be required by applicable regulations and standards, the Contractor shall provide a detailed submittal for each placement of a construction crane or other lifting equipment. The submittal shall reflect compliance with all safety codes and standards and shall be site specific for each placement.

1.05 OVERTIME

A. Compliance with Section 01140 may require work outside of normal hours including weekend work. The Contractor shall include the costs for such work including lighting facilities, etc. in the Contract Amount.

1.06 UTILITIES, START-UP AND TESTING OF OWNER SUPPLIED EQUIPMENT

A. Refer to Section 01510 for Contractor responsibilities for utilities to be provided for field personnel associated with Owner Supplied Equipment.

B. Refer to Section 01750 for Contractor responsibilities for testing and start-up services associated with Owner Supplied Equipment.

1.07 CONTRACT METHOD

A. Construct the Work under a single contract. Certain materials as described in the Contract Documents will be furnished by Owner for unloading, storing,
installation, start-up and testing assistance by the Contractor. The Contractor shall provide coordination and technical support associated with Owner furnished material.

1.08 WORK BY OTHERS

A. During the construction period for this project, the Owner (either with his own forces or under a separate contract) will be performing other work that will require the cooperation of the Contractor in scheduling and his coordination to avoid conflicts.

B. Refer to text in this Section and on the Contract Drawings for information and requirements regarding installation work to be provided a part of the Owner Furnished Equipment.

END OF SECTION
SECTION 01120
SEQUENCE OF WORK

PART 1 – GENERAL

1.01 SECTION INCLUDES

Project completion milestones and constraints regarding construction sequence.

1.02 CONSTRUCTION SEQUENCING - GENERAL

A. The following construction constraints and work sequences are not intended to be a complete or exhaustive list, and the descriptions provided are general in nature. The Contractor is responsible for identifying all work activities that could affect any operational aspect of the water treatment, the wastewater treatment or the irrigation water operations at the Port of the Islands, and providing the Owner and Engineer sufficient prior notice. Refer to Sections 01140 and 01150 for additional information and requirements. The following work sequences are intended to be general in nature and not inclusive of all steps or details. The Contractor can submit alternative work sequences to the Engineer for review.

B. Construct new water treatment plant:
   a. Site earthwork and general grading.
   b. Completion of utilities required for erection of the new structures.
   c. Completion of new structures.
   d. Complete installation of equipment, piping, electrical, fire sprinkler, HVAC, painting, plumbing and all other trades.
   e. Obtain Certificate(s) of Occupancy for new building.
   f. Start-up and testing of all equipment and systems including Owner Furnished Equipment.
   g. Demonstration of reliable operation of the new water treatment plant. See Section 01110 for additional information and requirements.

C. Complete repairs to, and demolition of, the existing water treatment plant as noted in the Contract Documents.

D. Complete as-built drawings and O&M manuals and complete all remaining Contract Work.

1.03 CONSTRUCTION SEQUENCING – ELECTRICAL

A. The existing electrical utility power feed for the existing water treatment plant must be relocated prior to construction of the new water treatment plant building. This work shall be completed in two stages so as to minimize time
spent off of utility power. The first phase will be installing new handholes, conduit and wiring in preparation for the wiring tie-in at each end of the new conduit and wiring, which is shown on the Electrical Drawings. The second phase will be a period up to six continuous hours for the wiring tie-ins. During this period, the existing water treatment plant shall be operated on power from the standby generator. Following successful completion of the second phase, demolition of the existing feeder can commence. Refer to the Electrical Drawings for more information.

B. The existing duct and fiber optic cable between the existing one story steel building at the wastewater treatment plant and the existing water treatment plant must be relocated prior to construction of the new water treatment plant building. This work shall be completed in two phases so as to minimize the down time of the SCADA system for the existing water treatment plant and the three raw water wells. The first phase will be installing new duct and fiber optic cable in preparation for connection of the cable at each end. The second phase will be making the cable connections at each end and shall not last longer than 48 continuous hours. Following successful completion of the fiber optic cable tie-ins and satisfactory operation of the existing SCADA system, demolition of the existing fiber optic cable and duct can commence.

PART 2 – PRODUCTS (not used)

PART 3 - EXECUTION (not used)

END OF SECTION
PART 1 - GENERAL

1.01 THE REQUIREMENT

A. Payment for the various items in the Schedule of Payment as further specified herein, shall include all compensation to be received by the Contractor for furnishing all tools, equipment, supplies, and manufactured articles, and for all labor, operations, taxes, materials, commissions, transportation and handling, bonds, permit fees, insurance, overhead and profit, and incidental appurtenant to the items of Work being described, as necessary to complete the various items of the Work all in accordance with the requirements of the Contract Documents, including all appurtenances thereto, and including all costs of compliance with the regulations of public agencies having jurisdiction, including Safety and Health Requirements of the Occupational Safety and Health Administration of the U.S. Department of Labor (OSHA). Such compensation shall also include payment for any loss or damages arising directly or indirectly from the Work.

B. The Contractor's attention is called to the fact that the quotations for the various items of Work are intended to establish a total price for completing the Work in its entirety. Should the Contractor feel that the cost for any item of Work has not been established by the Schedule of Payment items or this Section, it shall include the cost for that Work in some other applicable bid item, so that its proposal for the project does reflect its total price for completing the Work in its entirety.

1.02 PAYMENT ITEMS

A. The Contractor shall submit a Schedule of Payment Values for review with the return of the executed Agreement to the Owner. The schedule shall contain the installed value of the component parts of Work broken down into labor and material categories for the purpose of making progress payments during the construction period.

B. The schedule shall be given in sufficient detail for proper identification of Work accomplished. The Schedule of Payment Values shall coincide with the activities of work detailed in the construction progress schedule and the construction network analysis in order to accurately relate construction progress to the requested payment. Each item shall include its proportional share of all costs including the Contractor's overhead, contingencies and profit. The sum of all scheduled items shall equal the total value of the Contract.

C. If the Contractor anticipates the need for payment for materials stored on the project site, it shall also submit a separate list covering the cost of materials, delivered and unloaded with taxes paid. This list shall also include the installed value of the item with coded reference to the Work items in the Schedule of Payment Values. Similar procedures shall be employed for undelivered specifically manufactured equipment and materials as specified herein.

D. Payment will not be made for materials stored off-site.
PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION
SECTION 01135
ALLOWANCES

PART 1 - GENERAL

1.01 SECTION INCLUDES

Requirements and procedures relative to allowances.

1.02 CONTRACT ALLOWANCE

The Contractor shall include in its Contract Price an allowance equal to the Allowance Funds shown in the proposal for additional work required due to unforeseen conditions and conflicts and for additional work as may be requested by the Owner, and the Allowance Fund shall only be used at the Owner’s discretion. The price negotiated (between Contractor and Engineer) for any work falling under this category shall be compensation in full for all labor, materials and equipment necessary. All amounts remaining in this account at the completion of the project shall be credited to the Owner. The provisions for the Allowance Fund is not a guarantee the Contractor will be paid any portion or the full amount of such Allowance Funds.

1.03 ALLOWANCE FUND

A. Costs Included in Allowances

1. Payroll costs for employees in the direct employ of Contractor in the performance of the Work at the project site under schedules of job classifications as may be agreed upon by Owner and Contractor. Payroll costs shall include, but not be limited to, salaries and wages plus the cost of fringe benefits which shall include social security contributions, unemployment, excise and payroll taxes, workers’ compensation, health and retirement benefits, bonuses, sick leave, vacation and holiday pay applicable thereto.

2. Cost of materials and equipment furnished and incorporated in the Work, including costs of transportation and storage thereof, and Suppliers' field services required in connection therewith. Cash discounts shall accrue to Contractor unless Owner deposits funds with Contractor with which to make payments, in which case the cash discounts shall accrue to Owner. Trade discounts, rebates and refunds and returns from sale of surplus materials and equipment shall accrue to Owner, and Contractor shall make provisions so that they may be obtained.

3. Payments made by Contractor to the Subcontractors or private utility companies for Work performed or furnished by Subcontractors.

4. Proportion of necessary transportation, travel and subsistence expenses of Contractor's employees incurred in discharge of duties connected with the Work.

5. Cost, including transportation and maintenance, of materials, supplies, equipment, machinery, appliances, office and temporary facilities at the site and hand tools not owned by the workers, which are consumed in the performance of
the Work, and cost less market value of such items used but not consumed which remain the property of Contractor.

6. Rentals of construction equipment and machinery and the parts thereof whether rented from Contractor or others in accordance with rental agreements approved by Owner with the advice of Engineer, and the costs of transportation, loading, unloading, installation, dismantling and removal thereof, all in accordance with the terms of said rental agreements. The rental of any such equipment, machinery or parts shall cease when the use thereof is no longer necessary for the Work.

7. Sales, consumer, use or similar taxes related to the Work, and for which Contractor is liable, imposed by Laws and Regulations.

B. Costs Considered As Part of Profit

1. Losses and damages (and related expenses) caused by damage to the Work sustained by Contractor in connection with the performance and furnishing of the Work.

2. The cost of utilities, fuel and sanitary facilities at the site.

3. Minor expenses such as telegrams, long distance telephone calls, telephone service at the site, expressage and similar petty cash items in connection with the Work.

4. Payroll costs and other compensation of Contractor's officers, executives, project manager, principals (of partnership and sole proprietorships), general managers, engineers, architects, estimators, attorneys, auditors, accountants, purchasing and contracting agents, expediters, timekeepers, clerks and other personnel employed by Contractor whether at the site or in Contractor's principal or a branch office for general administration of the Work.

5. Expenses of Contractor's principal and branch offices other than Contractor's office at the site.

6. Any part of Contractor's capital expenses, including interest on Contractor's capital employed for the Work and charges against Contractor for delinquent payments.

7. Costs due to the negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable, including but not limited to, the correction of defective Work, disposal of materials or equipment wrongly supplied and making good any damage to property.

8. Other overhead or general expense costs of any kind and the costs of any item not specifically and expressly included in paragraph 1.03A. "Costs Included in Allowances".

C. Contractor Responsibilities

1. Request proposals from three suppliers and installers and offer recommendations.
2. On notification of selection by Engineer, execute purchase agreement with designated supplier and installer.

3. Arrange for and process any required shop drawings, product data, and samples. Arrange for delivery.

D. Engineer Responsibilities

1. Owner Contingency: Consult with Contractor in consideration and selection of services, products, suppliers and installers.

2. Owner Contingency: Select Products in consultation with Owner and transmit decision to Contractor.

3. Owner Contingency: Assist Owner to establish price for each allowance item through negotiation with Contractor.

4. Prepare authorization for expenditure of funds against allowance.

5. Prepare Change Order at close-out of Contract to reduce final Contract amount by the amount of unexpended funds remaining in Contingency Allowance.

E. Price for Each Allowance Item

1. Price for each allowance item shall be negotiated separately.

2. Price for each allowance item shall be negotiated between the Contractor and the Owner with the assistance of the Engineer.

F. At close-out of Contract, funds remaining in Contingency Allowance will be credited to Owner by Change Order.

1.04 PROFIT

Costs included in Allowances: Contractor’s profit on allowances shall be no more than 10% except for subcontractor’s work which shall be priced at 5%.

1.05 ALLOWANCE FUND

A. Provide the following amount as part of the Contract Price, which may be used for the following Owner Directed Work: $300,000

1. Purchase of 3,000 lb. capacity electric forklift, office furniture, workshop benches and shelving, and critical spare parts as may be required during the testing and performance phases of the new water treatment plant.

2. Allowance for Owner’s use as directed for work and costs associated with additional features and improvements as may be requested.

3. Allowance for Owner’s use as directed for unforeseen work and costs associated with the modifications to existing structures and changes due to existing underground improvements.

B. The inclusion of the Allowance Fund in the Contract Price is not a guarantee the
Contractor will be paid any portion or the full amount of the Allowance Fund.

PART 2 - PRODUCTS (not used)

PART 3 - EXECUTION (not used)

END OF SECTION
SECTION 01140

MAINTENANCE OF UTILITY OPERATIONS

PART 1 - GENERAL

1.01  THE REQUIREMENT

A. The existing water treatment, wastewater treatment and irrigation water systems will be maintained in continuous operation by the Owner during the entire construction period of the Contract as hereinafter specified.

B. Work shall be scheduled and conducted by the Contractor so as not to impede any treatment process, operating system or cause odor or other nuisance except as explicitly permitted hereinafter. In performing the work shown and specified, the Contractor shall plan and schedule his work to meet the systems’ operating requirements, and the constraints and construction requirements as outlined in this Section. The Contractor shall pay all civil penalties, costs, assessments, etc., associated with any discharge of inadequately treated water or wastewater associated with the Contractor's work.

C. The General Contractor shall be responsible for coordinating the general construction and the schedules of mechanical, electrical, HVAC, plumbing and related trades and for ensuring that permanent or temporary power and controls are available for all existing, proposed, and temporary facilities that are required to be on line at any given time.

1.02  GENERAL CONSTRAINTS

A. The Contractor shall schedule the Work so that the water treatment, wastewater treatment and irrigation water plants are maintained in continuous operation. All treatment processes shall be maintained in continuous operation during the construction period. Several items of work require connections of new piping and/or utilities to existing piping, utilities, or modifications to existing piping, utilities or facilities. Except as noted herein, the Owner will not allow shutdowns of the existing water treatment plant, any of its processes, or its water distribution system (in part or in its entirety) to facilitate these connections and/or modifications. The Contractor shall be responsible for, and include in its Contract bid amount, all costs associated with necessary work to isolate the existing piping, utilities or facilities to complete the required connections and/or modifications. Necessary work required by the Contractor shall include, but shall not be limited to, temporary bypass pumping and piping, wet taps, line stops, line plugs, and temporary bulkheads.

B. The Contractor shall review all bidding documents and shall be responsible to determine all such connections or modifications, and the scope and cost of all temporary measures required to isolate the work area without the need for a shutdown of the affected facility, process area, piping or utility.

C. The Contractor shall furnish any temporary work, facilities, roads, walks, protection of existing structures, piping, pipe stops, blind flanges, valves, equipment, electrical work, power supply, controls, etc. that may be required to maintain continuous and dependable operation of the water treatment, wastewater treatment and irrigation water plants and facilities at no extra cost to the Owner.
D. The Owner shall have the authority to order Work postponed, stopped or prohibited that would, in his opinion, unreasonably result in interrupting the necessary functions of the plant operations.

E. If the Contractor impairs performance or operation of the plant as a result of not complying with specified provisions for maintaining plant operations, then the Contractor shall immediately make all repairs or replacements and do all work necessary to restore the plant to operation to the satisfaction of the Owner and the Engineer. Such work shall progress continuously to completion on a 24-hours per day, seven work days per week basis.

F. The Contractor shall provide the services of emergency repair crews on call 24-hours per day at no additional cost to the Owner.

1.03 GENERAL OPERATING REQUIREMENTS, CONSTRAINTS, AND CONSTRUCTION REQUIREMENTS

A. Any tie-in or connection to an existing system or any interruption of service as may be allowed and specifically identified in the Contract Documents shall not commence until a detailed plan and schedule are approved by the Engineer. The Contractor shall submit a written plan and detailed schedule describing the tie-in, connection or shut-down and listing all planned labor, equipment, material and other resources. Each plan shall include a contingency plan in the event the connection or tie-in or modification is aborted. The plan must be submitted at least seven working days prior to the scheduled event.

B. Access to Plant Site, Roadways, and Parking Areas

1. An unobstructed traffic route through the Facility gates shall be maintained at all times for the Owner's operations personnel and maintenance equipment. The General Contractor shall be responsible for providing access to and for preparing and maintaining approved parking areas.

2. An unobstructed traffic route around the plant site shall be maintained at all times for the Owner's operations personnel and maintenance equipment. Vehicular access to the treatment units and buildings for Owner personnel shall be maintained at all times by the Contractor.

3. When vehicles are leaving the site, a wash down pit shall be provided and utilized to remove all mud and other contaminants before entering a public roadway.

4. The Contractor shall provide temporary measures to protect the existing pavement by filling over with earthen material or supplying other measures acceptable to the Engineer, and he shall repair any damage to existing paved surfaces that occurs during the construction period. Any areas disturbed along the shoulders of the access road and interior roads and elsewhere inside and outside of the plant shall be repaired, graded, seeded, etc. as necessary to match pre-existing conditions.

5. The General Contractor shall not undertake the restoration/construction of new roadway (paved, gravel, or asphalt overlay) shown on the Contract Drawings, until all other work on the plant improvements has been completed.
6. It shall be the responsibility of the General Contractor to obtain any permits required from the Florida Department of Transportation and pay all associated fees.

C. Personnel Access

1. Treatment plant personnel shall have access to all areas which remain in operation throughout the construction period. The Contractor shall locate stored material, dispose of construction debris and trash, provide temporary walkways, provide temporary lighting, and other such work as directed by the Engineer to maintain personnel access to areas in operation. Access and adequate parking areas for plant personnel must be maintained throughout construction.

D. Plumbing Facilities

1. Unless otherwise allowed by the Engineer, sanitary facilities in the existing structures shall be operational at all times for plant operating personnel. All other building plumbing systems such as roof and floor drains, pumping, etc., shall be maintained for all structures.

E. Building Cooling and Ventilating

1. Building air conditioning, cooling and ventilating for the existing plant structures shall be in service for the entire construction period. Additional temporary air conditioning, cooling and ventilation shall be provided as required to maintain facilities under construction adequately cooled and vented. The temperatures to be maintained in any areas occupied by plant operating personnel such as offices, lunchrooms, locker rooms, bathrooms, etc., shall be no more than 76 degrees Fahrenheit.

F. Power, Light and Communications Systems (General)

1. Electric power, lighting service and communications systems shall be maintained in uninterrupted operation in all areas which remain in operation. Individual units may be disconnected as required for replacement, but service shall be available at all times including periods when plant elements are out of service. The Owner may allow outages under conditions determined by the Owner by making use of the existing and/or the proposed engine-generator at the plant. All costs associated with operation of the engine-generators shall be paid by the Contractor. The Contractor shall coordinate shutdowns required by subcontractors to minimize the total number of shutdowns required to complete construction. Owner's phone service to the plant shall be maintained in continuous operation during construction.

G. Draining Process Pipes and Conduits (General)

1. The contents of all pipes and conduits to be removed, replaced or relocated (or dewatered for a specific purpose) shall be transferred to a suitable facility in a manner approved by the Owner through hoses or piping, or by using pumps if hydraulic conditions so require them. The Contractor shall provide the pumps, piping and hoses at no additional cost to the Owner. No uncontrolled spillage of a pipe or conduit shall be permitted.
H. Potable Water System

1. Potable water service shall be maintained in continuous service at all times during construction except for short term interruptions required for tie-ins. Shutdown of the potable water system shall be fully planned and coordinated with the Plant Superintendent and shall be limited to not more than two (2) hours. Existing fire hydrants within the plant site shall be operational at all times, unless otherwise approved by the Owner.

I. Non-potable Water System

1. Existing fire hydrants within the plant site shall be operational at all times, unless otherwise approved by the Owner.

J. Sump Pumps and Sumps

1. All existing sumps shall be maintained in an operable condition with either existing pumps or temporary pumps. Interim piping, power and controls shall be provided as required by the staged construction sequence.

K. Seal Water and Service Water Piping

1. A supply of service and seal water and the necessary connections to existing equipment shall be maintained during construction. Interim piping shall be provided as required.

PART 2 – PRODUCTS (not used)

PART 3 – EXECUTION (not used)

END OF SECTION
SECTION 01150

PROTECTION OF EXISTING FACILITIES

PART 1 – GENERAL

1.01 SECTION INCLUDES

Requirements for protection of existing facilities and completed construction

1.02 GENERAL

A. The Contractor shall protect all existing utilities and improvements not designated for removal and shall restore damaged or temporarily relocated utilities and improvements to a condition equal to or better than they were prior to such damage or temporary relocation, all in accordance with requirements of the Contract Documents.

B. The Contractor shall verify the exact locations and depths of all utilities shown and the Contractor shall make exploratory hand excavations of all utilities that may interfere with the Work. All such exploratory hand excavations shall be performed as soon as practicable after award of Contract and, in any event, a sufficient time in advance of construction to avoid possible delays to the Contractor's Work. When such exploratory excavations show the utility location as shown to be in error, the Contractor shall so notify the Engineer.

C. The number of exploratory excavations required shall be that number which is sufficient to determine the alignment and grade of the utility.

1.03 RIGHTS-OF-WAY

A. The Contractor shall not do any Work that would affect any oil, gas, sewer or water pipeline, any telephone, telegraph or electric transmission line, any fence or any other structure nor shall the Contractor enter upon the rights-of-way involved until notified by the Engineer that the Owner has secured authority therefor from the proper party. After authority has been obtained, the Contractor shall give said party due notice of its intention to begin Work.

B. When two or more contracts are being executed at one time on the same or adjacent land in such manner that Work on one contract may interfere with that of another, the Owner shall determine the sequence and order of the Work.

C. When the territory of one contract is the necessary or convenient means of access for the execution of another contract, such privilege of access or any other reasonable privilege may be granted by the Owner to the Contractor so desiring, to the extent, amount, in the manner, and at the times permitted.

D. No such decision as to the method or time of conducting the Work or the use of territory shall be made the basis of any claim for delay or damage.
E. The Owner's Right of Access is reserved to the Owner and to the owners of public utilities and franchises to enter at any time upon any public street, alley, right-of-way, or easement for the purpose of making changes in their property.

1.05 PROTECTION OF SURVEY STREET OR ROADWAY MARKERS

The Contractor shall not destroy, remove, or otherwise disturb any existing survey markers or other existing street or roadway markers without proper authorization. No pavement breaking or excavation shall be started until all survey or other permanent marker points that will be disturbed by the construction operations have been properly referenced for easy and accurate restoration. It shall be the Contractor's responsibility to notify the Owner of the time and location that Work will be done. Such notification shall be sufficiently in advance of construction so that there will be no delay due to waiting for survey points to be satisfactorily referenced for restoration.

1.06 EXISTING UTILITIES AND IMPROVEMENTS

A. Maintaining in Service: All oil and gasoline pipelines, power, and telephone or other communication cable ducts, gas and water mains, irrigation lines, sewer lines, storm drain lines, poles, and overhead power and communication wires and cables encountered along the line of the Work shall remain continuously in service during all the operations under the Contract, unless other arrangements satisfactory to the Engineer are made with the owner of said pipelines, duct, main, irrigation line, sewer, storm drain, pole, wire or cable.

B. The Contractor shall protect all underground utilities and other improvements which may be impaired during construction operations. It shall be the Contractor's responsibility to ascertain the actual location of all existing utilities and other improvements that will be encountered in its construction operations, and to see that such utilities or other improvements are adequately protected from damage due to such operations. The Contractor shall take all possible precautions for the protection of unforeseen utility lines to provide for uninterrupted service and to provide such special protection as may be necessary.

C. Where the proper completion of the Work requires the temporary or permanent removal, or relocation of an existing utility or other improvement which is shown, the Contractor shall contact the utility owner and proceed as specified in Section 01160 – Alteration of Existing Facilities.

D. Unrecorded Underground Utilities or Improvements

1. Plans show features of topography and underground utilities, but do not purport to show in complete detail all such lines or obstructions.

2. Existing utilities shown on Drawings are based upon available records. Data regarding existing utilities is presented for Contractor's convenience only, and shall not be used as a basis for claims of extra compensation.

3. Examine available records and make exploratory excavations whenever necessary to determine locations of existing pipes, valves, or other underground improvements.
4. Take prudent precautions not to damage unrecorded underground utilities and improvements.

5. If unrecorded underground utilities or other improvements are encountered, immediately notify the Engineer and inform the Engineer of the conditions encountered. Include written report of conditions encountered with Progress Schedule covering period in which unrecorded underground utilities or improvements were encountered. Provide unscheduled impact on CPM schedule for each occurrence. If unrecorded underground utilities or improvements conflict with Work, changes shall be made under the terms of the Agreement. Changes to the Work shall be as approved by the Owner.

6. The Contractor shall contact the affected utility owner and proceed as specified in Section 01160 – Alteration of Existing Facilities.

1.07 TREES WITHIN STREET RIGHTS-OF-WAY AND PROJECT LIMITS

A. The Contractor shall exercise all necessary precautions so as not to damage or destroy any trees or shrubs, and shall not trim or remove any trees unless such trees have been approved for trimming or removal by the jurisdictional agency or Owner.

B. All existing trees and shrubs which are not to be removed and are damaged during construction shall be repaired or replaced by the Contractor as specified in Section 01160 – Alteration of Existing Facilities.

1.08 NOTIFICATION BY THE CONTRACTOR

Prior to any excavation in the vicinity of any existing underground facilities including all water, sewer, storm drain, gas, petroleum products or other pipelines; all buried electric power, communications or television cables; all traffic signal and street lighting facilities; and all roadway and state highway rights-of-way, the Contractor shall notify the respective authorities representing the owners or agencies responsible for such facilities not less than 3 days nor more than 7 days prior to excavation so that a representative of said owners or agencies can locate their facilities or be present during such work if they so desire.

PART 2 – PRODUCTS (not used)

PART 3 – EXECUTION (not used)
SECTION 01160

ALTERATION OF EXISTING FACILITIES

PART 1 - GENERAL

1.01 SECTION INCLUDES

Requirements and procedures for alterations and restoration.

1.02 SITE AND BUILDINGS

A. Site Visit

1. Prior to submission of Bids, the Contractor shall have visited the site and thoroughly acquainted himself with the exact nature of the work indicated on the Drawings and the Specifications requirements. Failure to comply with the aforementioned requirements shall not constitute a basis for claims for additional compensation.

B. Measurements and Notice

1. Prior to ordering any materials or doing any work, the Contractor shall verify all measurements, dimensions and other conditions of each building scheduled for work as may be necessary or required in connection with his work. The Contractor shall be responsible for the correctness of same. Provide three working days notice to the Owner prior to commencing cutting or alterations.

1.03 SUBMITTALS

A. General: as specified in Section 01330 – Submittals.

B. In addition, submit the following:

1. Written request for authorization to perform cutting or alteration.

   a. Submit written request in advance of cutting, restoration, or alteration which affects:

      (1) Structural integrity of any element of Project.
      (2) Integrity of weather-exposed or moisture-resistant element.
      (3) Efficiency, maintenance, or safety of any operational element.
      (4) Visual qualities of sight-exposed elements.
      (5) Work of Owner or separate contractor.

   b. Include in request:

      (1) Identification of Project.
(2) Location and description of affected work.
(3) Necessity for cutting, restoration, or alteration.
(4) Description of proposed work, and products to be used.
(5) Alternatives to cutting, restoration, or alteration.
(6) Effect on work of Owner or separate contractor.
(7) Written permission of affected separate contractor.
(8) Date and time that work will be executed.

2. Shop drawings for fabricated items to be used in alterations and restoration.

3. Product data for items and materials to be used in alterations and restoration.

4. Request for substitution as specified in Section 01600 – Material and Equipment

1.04 SHORING, UNDERPINNING AND BRACING

A. When necessary and required, the Contractor shall provide underpinning and temporary shoring and bracings, all in accordance with code requirements, and as approved by the Engineer. The underpinning, shoring and bracing shall be based on calculations and drawings provided by a Florida licensed P.E. Submit calculations and drawings for the Engineer for review prior to commencing work.

B. Shoring and bracing shall be of such form and so installed as to safely support the work and interfere as little as possible with the progress of the work. Suitable means shall be provided to adjust any settlement in the shorings supports. Temporary shoring shall consist of sound timbers or rolled shapes of required dimensions which shall be removed after necessity for same ceases to exist. All work removed or damaged through installation of temporary shoring or through improper shoring shall be replaced or repaired after the shoring is removed, at no additional cost to the Owner.

1.05 WORK PREPARATION AND TEMPORARY ACCESS

A. The Contractor, before commencing work, shall prepare and submit for approval a progress schedule in accordance with the requirements of Section 01330, “Submittals”, in order to coordinate the work of all trades and to insure completion on or before the completion date. The Owner and the Engineer reserve the right to revise or modify such schedules as required to expedite each phase of work and to coordinate such work with the partial use of the building for purposes as directed.

B. No facility such as toilets, corridors, etc., shall be barricaded or access restricted without providing other temporary or interim means of access. It is further required that no work specified hereinafter shall disturb or interfere with the operation of the existing mechanical installation until proposed new work has been completed or satisfactorily installed. Exception may be made to this requirement only by written approval from the Owner and Engineer.
C. Detailed sequence of availability of areas within the present buildings where work is to be performed under each Contract shall be in accordance with Section 01140, Maintenance of Utility Operations, but may be modified by the Contractor, upon authorization by the Owner and Engineer as the work progresses.

D. Existing built-in equipment to remain in the final work, but requiring temporary removal for the installation of new construction, alterations, repairs and/or renovations, shall be disconnected by the Contractor and removed to temporary storage areas designated by the Owner. Resetting of existing equipment under this heading shall be performed by the Contractor including connecting to electric service lines.

E. The Contractor shall furnish and install all temporary fire exists, fire extinguishers, hose and safety devices as may be required by authorities having jurisdiction.

F. Work within existing buildings to be performed, once started, shall be completed as quickly as practicable and each trade shall determine before work is started that all required materials are at hand or readily obtainable to avoid delays.

G. Shutdowns of existing services within existing buildings which may be occupied during construction will be permitted only upon written approval by the Owner subject to at least three weeks notice in writing to the Owner in each case. Shutdowns will be limited to times which will result in the least interference with normal operations.

1.06 EXISTING UTILITIES AND IMPROVEMENTS

A. General

1. Ascertain the actual location of existing utilities and improvements that will be encountered.

2. Protect existing utilities and improvements.

3. Supervise and observe excavation operations.

B. Public Utilities and Franchise Utilities (Utilities)

1. General: Do not interrupt service of any utility without notification and approval of applicable utility.


3. Work on Owner’s Property

   a. Notify the Engineer prior to performing excavations in areas where existing utilities may be encountered.

   b. Do not perform excavations until underground utilities have been located by utilities having property in the area to be excavated.
4. Relocation of Utility Property
   a. If is necessary to relocate the property of any utility, the utility property will be relocated by the applicable utility unless otherwise shown or specified.
   b. If utility property is shown or specified to be relocated by the Contractor, relocate utility property in accordance with the written instructions or recommendations of the applicable utility.
   c. Notify Engineer and applicable utility a sufficient time in advance of relocation for the following:
      (1) Measures to be taken which prevent, or minimize, interruption of service.
      (2) Scheduling of personnel to perform, observe, or perform and observe relocation.
   d. Provide access to applicable utility personnel, vehicles, and equipment required to perform, observe, or perform and observe relocation of utility property.

5. Repair of Utility Property
   a. If service of utility is interrupted or property of utility is damaged without notification and approval of applicable utility, immediately notify Engineer, Owner, and affected utility.
   b. Service interruption and property damage shall be corrected and repaired by affected utility, unless otherwise approved by Engineer and affected utility.
   c. Repairs by Contractor shall be done in accordance with instructions of the affected utility. All repairs shall be subject to inspection and approved by an authorized representative of the utility before being concealed by backfill or other work.
   d. Repairs and fines related to unscheduled interruptions, or damage shall be paid by the Contractor with no additional cost to the Owner.

C. Owner's Utilities, Process Piping, and Improvements

1. General
   a. Do not interrupt service of Owner's existing utilities, process piping, or other improvements without 7 days prior notification and written approval of Engineer.
   b. Interruptions of Owner's utilities, process piping, and other improvements shall be minimized and shall meet the requirements of Sections 01110, 01120 and 01140.
2. Repair of Owner's Utilities and Improvements
   a. If Owner's utilities, process piping, or other improvements are interrupted or
damaged without notification and approval, immediately notify Engineer and
Owner.
   b. Unscheduled service interruption damage shall be repaired as follows:
      (1) Contractor shall take immediate actions to shut off flows, shut off
pumps, shut off equipment, and contain spills as applicable to the
   event.
      (2) Engineer shall direct Contractor to make repairs, assist Owner in
making repairs, or provide access to event site for Owner to make
   repairs.
   c. Repair work by Contractor shall meet the requirements of the Owner.
   d. Repairs and fines related to unscheduled interruptions, or damage shall be
paid by the Contractor with no additional cost to the Owner.

PART 2 - PRODUCTS

2.01 PRODUCTS FOR ALTERATIONS AND RESTORATION
   A. Type and Quality of Existing Products: Determine by inspecting and testing existing
products where necessary, referring to existing work as a standard.
   B. Products for Restoration: Products identical to, or equal to, products used in existing
work when new.
   C. Products for Alterations: As specified in individual product specification Sections
applicable to products.

PART 3 - EXECUTION

3.01 EXAMINATION
   A. Inspect existing conditions, including elements subject to damage or movement
during alteration, restoration, or alteration and restoration.
   B. Remove debris and abandoned items from areas of alteration and renovation work
and from concealed spaces.
   C. Verify that demolition is complete.
   D. Verify that areas are ready for installation of new work.
E. Beginning of restoration work or alteration work means acceptance of existing conditions.

3.02 PREPARATION

A. Provide supports to assure structural integrity of surroundings. If supports are provided for structural members, details and calculations must be prepared by a Florida licensed P.E. and submitted for review prior to commencing installation of such supports.

B. Close openings in exterior surfaces so that existing work and salvage items are protected from weather and extremes of temperature and humidity. Insulate ductwork and piping to prevent condensation in exposed areas.

C. Maintain excavations free of water.

D. Provide barriers, covers, and other protection required to prevent structural elements, equipment, piping, conduit, paving, finishes, and other adjacent improvements from being damaged.

E. Cut, move, or remove items as necessary for access to alterations and renovation work. Replace and restore at completion.

F. Remove unsuitable material not marked for salvage, such as rotted wood, corroded metals, and deteriorated masonry and concrete.

G. Remove and cut work so that damage is minimized. Remove and cut work to provide a means of restoring products and finishes as follows:

1. If products, finishes, or products and finishes are specified, restore work to specified condition.

2. If products, finishes, or products and finishes are not specified, restore work to original condition.

H. Remove surface finishes and prepare surfaces to provide for proper installation of new work and finishes.

3.03 OPENINGS IN CONCRETE AND MASONRY

A. Rectangular Openings

1. Where new rectangular openings are to be made in concrete or masonry walls or floors, score edges of each opening. Score both sides of exposed walls and elevated slabs. Score concrete and masonry by saw cutting clean, straight lines to a minimum depth of one inch. After scoring concrete and masonry, chip out concrete and masonry, or saw cut completely through slab or wall to remove concrete and masonry. Do not allow saw cuts deeper than one inch, or the depth of cover over existing reinforcing steel, whichever is less, to extend beyond limits of new opening. Make corners square and true by combination of core drilling, chipping, or grinding. Do not leave any rough edges.
2. Repair saw cuts beyond new opening by filling saw cut with non-shrink grout.

3. Chip back concrete around reinforcing steel exposed by cutting and repair as per Section 02220, 3.04. Cut exposed steel, coat ends with corrosion inhibitor, and fill cavities with an approved non-shrink grout unless noted otherwise.

4. Grout inside face of new opening so that voids are filled and exposed aggregate is covered. Finish grout so that opening is level, plumb, and square.

B. Circular Openings (Unless noted otherwise on the drawings)

1. Where circular openings are required in existing concrete walls and slabs for the installation of pipe, make openings by core drilling and chipping.

2. Cut exposed reinforcing steel and repair as per Section 02220, 3.04. Coat reinforcing steel with corrosion inhibitor.

3. Fill void between interior face of opening and exterior of pipe with an approved non-shrink grout so that there are no leaks around pipe or opening.

C. Grout shall be of proper color and finish to match existing surface color, finish and texture. Submit grout to Engineer for approval prior to procurement or installation. Provide coating system for similar concrete or masonry in Section 09850 – Paints and Coatings.

3.04 PLUGGING OPENINGS

Plug openings in wall, floors, and ceilings resulting from removal of existing equipment, piping, and conduit. Plug openings in a manner that will result in a structurally suitable seal and a neat and presentable appearance.

3.05 CUTTING PIPE AND CONDUIT

A. Where new piping is to be connected to existing piping, cut existing piping square. Properly prepare ends of pipe for connection indicated on the drawings. Repair damage to lining and coating of existing piping resulting from cutting.

B. Where existing piping or conduit is to be removed or abandoned in place, cut existing piping or conduit square or disconnect piping or conduit at an existing joint. Seal exposed ends of abandoned connections with plugs, caps, or blind flanges suited for material, type, and service of pipe or conduit.

3.06 REPAIR OF STRUCTURAL STEEL

A. Where existing structural steel members are removed or modified, repair remaining steel members which are damaged by construction activities or corrosion.

B. Prepare surfaces of repaired members and coat repaired members as specified in Section 09850 - Paints and Coatings.
3.07 DOORS, PASSAGEWAYS, AND WINDOWS

A. Dress jambs, sills, and heads of new doors, passageways, windows, or other openings cut into existing walls and slabs. Dress jambs, sills, and heads of new doors, passageways, windows, or other openings with new masonry, concrete, or metal.

B. Finish jambs, sills, and heads so that only finished edges and surface are exposed. Provide a smooth finished appearance.

3.08 TRANSITIONS

A. Where new work abuts or aligns with existing, perform a smooth and even transition. Patch work to match existing adjacent work in texture and appearance.

B. Where removal of partitions or walls results in adjacent spaces becoming one, rework floors, walls, and ceilings to a smooth plane without breaks, steps, or bulkheads. Trim existing doors as necessary to clear new floor finish. Refinish trim as required.

C. When finished surfaces are cut so that a smooth transition with new work is not possible, terminate existing surface along a straight line at a natural line of division and make recommendation to Engineer for transition from existing surface to new surface.

3.09 REPAIR OF DAMAGED SURFACES

A. Repair surfaces of walls or floors which are exposed by removals or demolition and which have holes, scars, chipped, or other damage revealed by removal or demolition.

B. Patch or replace portions of existing surfaces which are damaged, lifted, discolored, or showing other imperfections.

C. Repair substrate prior to patching finish.

3.10 FINISHES

A. Refinish visible existing surfaces to remain in renovated rooms and spaces, to specified condition for each material, with a neat transition to adjacent finishes.

B. Finish patches to product uniform finish and texture over entire area.

C. When finish cannot be matched, refinish entire surface to nearest intersections.

D. Finish surfaces as specified in individual Product Sections.

3.11 PAVEMENT RESTORATION

A. Restore pavement removed, cut, or damaged during construction.
B. If edges of pavement surface remaining are jagged or broken, saw cut surface course so that the pavement edge is clean, sound, and vertical.

C. Restore pavement as follows:

1. If pavement restoration detail is shown on the Drawings, restore pavement as shown in detail.

2. If no restoration details are shown on the Drawings, replace pavement with similar materials and of equal thickness to match existing undisturbed pavement.

3. Restoration of payment to comply with Collier County DOT Standards and Utilities Standards Manual, latest editions with revisions.

D. Following restoration or pavement cuts, overlay pavement.

1. If extent of overlay is shown on the Drawings, provide overlay as shown on Drawings.

2. If extent of overlay is not shown on the Drawings, provide continuous surface course overlay over all of the pavement cuts with 10' minimum overlap of existing pavement at each end of overlay.

3. Restoration of payment to comply with Collier County DOT Standards and Utilities Standards Manual, latest editions with revisions.

3.12 SIDEWALK RESTORATION

A. Restore sidewalks removed, cut, or damaged during construction.

B. Saw cut sidewalk at existing joint. If there are no existing joints, saw cut sidewalk perpendicular to the side of the sidewalk. Saw cut sidewalk so that the sidewalk edge is clean, sound, and vertical.

C. Replace sidewalk with similar materials and of equal thickness to match existing undisturbed sidewalk.

D. Sidewalk restoration shall comply with Collier County DOT Standards and Utilities Standards Manual, latest editions with revisions.

3.13 REPLACEMENT AND REPAIR OF TREES AND SHRUBS

A. Replace damaged trees and shrubs if damaged trees and shrubs if damaged plants cannot be repaired without destroying the value of the plants as screening or landscaping.

B. Replacement of Trees and Shrubs

1. Replacement plants for native varieties shall be same variety as plants removed.
2. Replacement plants for exotic varieties shall be native varieties.

3. Replacement plants shall be equal in size to plants removed or 1.5 times total diameter of removed plants if replacement plants are smaller than plants removed.

C. Repair of Trees and Shrubs.
   1. Preserve symmetry of trees and shrubs.
   2. Do not leave stubs, splits, or torn branches.
   3. Make clean cuts close to trunk or large branch.
   4. Coat cuts over 1-1/2" in diameter with asphaltic emulsion material.

3.14 DUST-PROOF PARTITIONS

A. The Contractor shall furnish and erect all necessary temporary dust-proof partitions where required to protect unaltered portions of existing buildings and structures or as directed by the Owner or Engineer.

B. Partitions shall be constructed of wood studs with plywood on both sides. Partitions shall extend from floor to ceiling with a closure plate at floor and ceiling. The Contractor shall furnish and install one door in each enclosure complete with hardware attached and keyed as directed. Such enclosures will be required in areas of major demolition work and for protection of existing equipment.

3.15 WEATHER PROTECTION

A. Where exterior walls or roofs are being altered, or disturbed for any adjacent alteration, the Contractor shall provide temporary weather protection in those areas to keep interior of buildings absolutely dry and unaffected by the weather. The Contractor will be held responsible for any damage caused by improper protection against weather.

B. Where existing exterior walls or roofs are disturbed due to alterations, disturbances shall be kept to a minimum and walls or roofs shall be repaired and patched in such a manner that the buildings will be absolutely watertight and meet the conditions of the existing roofing flashing and waterproofing bonds and guarantees.

3.16 CUTTING, PATCHING, REPAIRING, AND REFINISHING – GENERAL

A. The Contractor shall be responsible for cutting all openings in walls, floors and ceilings (indicated to remain) to accommodate alteration work under his Contract in accordance with the requirements of the General Conditions, Supplemental Conditions, and as hereinafter specified. Rough patching and all finish patching shall be by the Contractor.

1. Where new openings are to occur in existing exterior and interior concrete and masonry bearing walls and structural concrete floor, the Contractor will be
required to notify the Owner and Engineer in writing at least five full work days prior to commencing the cutting and shall obtain approval prior to cutting operations. The Engineer will determine whether such openings affect the structural stability or load bearing capacities of walls and floors.

2. All holes and openings to be cut in existing walls, floors and ceilings of any nature shall be geometrically correct and no larger than necessary to accommodate the new work.

3. No cutting of finished or structural work may be done without the approval of the Engineer.

B. Major demolition and removal work such as demolition of buildings and structures, complete or nearly complete removal of floors, walls and ceilings indicated on the Drawings, shall be performed by the Contractor. The Contractor shall also be responsible for all finish patching operations of holes and openings in existing floors, walls, ceilings and roofs to accommodate the alteration work under the Plumbing, HVAC and Electrical Sections as well as that required for the Contractor’s work hereinafter specified.

C. Each Contractor and/or his Subcontractors shall provide sleeves, forms and inserts for installation by the General Contractor as specified in Section 01010, Summary of Work.

3.17 EXISTING EQUIPMENT AND FURNISHINGS

A. Existing built-in equipment to remain in the final work and requiring temporary removal shall be as specified under this Section.

B. Existing appliances and portable equipment such as desks, chairs, tables, etc., shall remain the property of the Owner and will be removed from rooms and spaces to be altered by the Contractor prior to construction and alteration operations, and stored where directed by the Owner.

C. All unsalvageable equipment shall become the property of the Contractor in accordance with the requirements of Section 02220 and shall be removed from each building and away from the site. Equipment to be retained, or relocated, shall be as shown on the Drawings or as specified.

3.18 SCHEDULE OF INTERIOR FINISHES FOR EXISTING BUILDINGS

A. Unless otherwise specified, all materials required for the work in the existing buildings shall be new, and where required shall match existing adjacent finishes.

B. As indicated on the Drawings, specified or otherwise required to complete the work, the Contractor shall cut new openings and block up existing openings in floors, walls, partitions and ceilings; remove existing floors; remove, relocate existing and/or install new windows, doors, frames, transoms, access doors, partition sash and trim.
C. The Contractor shall remove window sash, frame, sill, stool and trim at exterior door openings to be blocked up; remove door, frame and trim and, unless otherwise hereinafter specified or indicated on the Drawings to be blocked up with other materials, window and door openings shall be blocked up with brick and/or masonry block.

1. At door, sash and other openings in interior partitions and wall to be closed, block up such openings with same materials and construction as adjacent, unless otherwise indicated on the Drawings. Plaster and finishes applied at blocked up openings shall finish even and straight, flush with and of the same texture or other surface characteristics of existing adjacent finishes.

D. Existing finishes or subfloor surfaces which are scheduled to receive new floor finishes shall be repaired, patched with concrete, asphalt latex type emulsion and underlayment as required to suit existing surfaces or the new floor surfacing material to be applied.

E. Concrete and floors disturbed by alterations shall be patched to finish even, straight and flush with adjacent surfaces.

F. Where new ceramic tile flooring or base is to be installed over present concrete floors or base, and where a cove exists at the floor, the Contractor shall cut away part of the cove by grinding or other approved means to the extent required for installation of the new flooring or base.

G. Existing partitions to be removed shall be removed for their entire height.

H. Where existing bases and other trim are removed and grounds are exposed and will not be covered by new finishing materials such as resilient base, new trim, or wall covering, grounds shall be removed and wall surfaces patched with plaster to finished even, straight and flush with adjacent existing plaster surfaces. Where existing plaster ceilings are scheduled to be removed, the ceilings shall be replaced with new metal furring, lathing and plaster finish or acoustical ceilings or other ceiling system as indicated on the Drawings.

I. Where partitions or walls are removed and existing ceiling on each side of the partition or wall is to remain, the gap shall be patched; a vertical break shall be provided if the ceilings are at different levels. Where the ceiling on one side is to remain and a new ceiling is scheduled for the area on the other side, the new ceiling shall be constructed so that the new and existing finished ceiling areas will be at the same level.

J. Existing floors, walls and ceilings shall be cut as required for removal of existing services and for installation of new plumbing, heating, ventilating and air conditioning, and electrical work and related piping, duct work, conduits, fixtures and equipment.

K. In addition to work specifically called for in the finish schedule on the Drawings, all finishes disturbed in the performance of any alterations or new work by a Contractor shall be patched or repaired to match existing surfaces or finishes. Holes, slots,
chases, etc., in floors, walls and ceilings left by the removal of existing, or installation of new piping, plumbing fixtures, radiators, duct work, registers, grills, conduit, receptacles, switches, lighting fixtures and other items of the other Contracts shall also be patched or repaired by the Contractor.

L. Existing spaces not listed on the finish schedule on the Drawings may require no work other than complete painting and patching by the Contractor of surfaces damaged in performance or any work included under this Contract.
SECTION 01200

PROJECT MEETINGS

PART 1 - GENERAL

1.01 PRECONSTRUCTION MEETING

A. A preconstruction meeting will be held after Award of Contract, but prior to starting work at the site. The Engineer shall prepare and distribute the meeting agenda and shall preside at the meeting. The Engineer shall record and distribute minutes of the proceedings and decisions.

B. Attendance:
   1. Owner
   2. Engineer
   3. Contractor
   4. Major subcontractors

C. Minimum Agenda:
   1. Tentative construction and submittal schedules
   2. Critical work sequencing
   3. Designation of responsible personnel
   4. Processing of Field Decisions and Change Orders
   5. Adequacy of distribution of Contract Documents
   6. Submittal of Shop Drawings and samples
   7. Procedures for maintaining record documents
   8. Use of site and Owner's requirements
   9. Major equipment deliveries and priorities
  10. Safety and first aid procedures
  11. Security procedures
  12. Housekeeping procedures
  13. Processing of Partial Payment Requests
14. General regard for community relations

1.02 PROGRESS MEETING

A. Progress meetings will be held biweekly at the Engineer’s Field Office during the performance of the work of this Contract. Additional meetings may be called as progress of work dictates.

B. Engineer will prepare and distribute agenda, preside at meetings and record minutes of proceedings and decisions. Engineer will distribute copies of minutes to participants.

C. Attendance:
   1. Owner
   2. Engineer
   3. Contractor
   4. Subcontractors, only with Engineer’s approval or request, as pertinent to the agenda

D. Minimum Agenda:
   1. Review and approve minutes of previous meetings.
   2. Review progress of Work since last meeting.
   3. Review proposed 30-60 day construction schedule.
   4. Note and identify problems which impede planned progress.
   5. Develop corrective measures and procedures to regain planned schedule.
   6. Revise construction schedule as indicated and plan progress during next work period.
   7. Maintaining of quality and work standards.
   8. Complete other current business.
   9. Schedule next progress meeting.

PART 2 – PRODUCTS (not used)

PART 3 – EXECUTION (not used)

END OF SECTION
SECTION 01310
CONSTRUCTION PROGRESS SCHEDULES

PART 1 - GENERAL

1.01 DESCRIPTION

A. Scope of Work:

1. Promptly after award of the Contract, prepare and submit to the Engineer estimated construction progress schedules demonstrating complete fulfillment of all Contract requirements utilizing a Critical Path Method (hereinafter referred to as CPM) in planning, coordinating, and performing the Work under this Contract (including all activities of subcontractors, equipment vendors, and suppliers). The principles and definition of CPM terms used herein shall be as set forth in the Associated General Contractors of America (AGC) publication, Construction Planning & Scheduling Manual, Copyright 1997, but the provisions of this Specification shall govern the planning, coordinating, and performance of the Work.

2. Submit revised progress schedules on a monthly basis. No partial payments shall be approved until there is an approved construction progress schedule on hand.

B. Related Requirements Described Elsewhere:

2. Summary and Sequence of Work: Sections 01110 and 01120.
3. Project Meetings: Section 01200.
4. Applications for Payment: Section 01027.
5. Shop Drawings, Working Drawings, and Samples: Section 01330.
6. Schedule of Values: Section 01130.

1.02 QUALIFICATIONS

A. A statement of computerized CPM capability shall be submitted in writing prior to the award of the Contract and shall verify that either Contractor's organization has in-house capability to use the CPM technique or that Contractor will employ a CPM consultant who is so qualified.

B. In-house capability shall be verified by description of construction projects to which Contractor or Contractor's consultant has successfully applied computerized CPM and shall include at least two (2) projects comparable in complexity and size as this project.

1.03 FORM OF SCHEDULES
A. Prepare schedules in the form of a horizontal bar chart printed in color with logic constraints shown.

1. Provide a separate horizontal bar for each trade or operation within each phase or structure.

2. Horizontal time scale:
   a. Show starting and completion dates for each activity in terms of the number of days after Notice to Proceed. All completion dates shown shall be within the period specified for contract completion.
   b. Identify the first work day of each month.

3. Scale and Spacing: Sufficient to allow space for notations and future revisions.


B. Format of Listings: The chronological order of the start of each item of work for each phase or structure.

C. Identification of Listings: By project phase as applicable and by structure.

D. Construction Progress Schedules shall be computer generated using software equal to Microsoft Project or approved equal.

1.04 CONTENT OF SCHEDULES

A. Construction Progress Schedule:

1. Show the complete sequence of construction by activity and by structure.

2. Show the dates for the beginning and completion of each major element of construction in no more than a 2 week increment scale. Specifically list, but do not limit to:

   a. Shop Drawing Schedule.
   b. Installation of temporary facilities.
   c. Site clearing.
   d. Site utilities.
   e. Structural work.
   f. Subcontractor work.
   g. Equipment installations.
   h. Instrumentation.
   i. Electrical.
   j. Operator training and furnishing operation and maintenance manuals.
   k. Equipment Testing.
   l. Equipment and process start-up.
   m. Receipt of spare parts.
   n. Project closeout.
3. Provide project phase for each schedule activity. Project phases include the following: Civil-Site Work, Structural-Architectural Work, Owner Furnished Equipment Installation, Equipment Installation, Electrical, Instrumentation, Tie-Ins and Connections.

4. Provide responsibility identifier for each scheduled activity. Special responsibility codes shall include, as a minimum, each major subcontractor (> 2% of Contract Cost), Owner furnished equipment, and witnessed equipment startup and testing.

5. Show projected percentage of completion for each item, as of the first day of each month.

6. Show projected dollar cash flow requirements for each month of construction and for each activity as indicated by the approved Schedule of Values.

B. Submittals for construction progress schedules shall be in accordance with Section 01330. Indicate on the schedule the following:

1. The dates for all Contractor submittals, including O&M manuals.

2. The date’s submittals will be required for Owner-furnished products, if applicable.

3. The dates approved submittals will be required from the Engineer.

C. A typewritten list of all long lead items (equipment, materials, etc.).

D. To the extent that the progress schedule or any revised progress schedule shows anything not jointly agreed upon or fails to show anything jointly agreed upon, it shall not be deemed to have been approved by the Engineer. Failure to include any element of work required for the performance of this Contract shall not excuse the Contractor from completing all work required within any applicable completion date, notwithstanding the Engineer’s approval of the progress schedule.

E. Scheduling Constraints: The Work must be completed within the maximum number of days, start to finish, as indicated in the Contract. Additionally, work must proceed on a continuous basis, without stoppages, except for nights and weekends. There shall be no lapses between phases of construction.

1.05 PROGRESS REVISIONS

A. Indicate progress of each activity to date of submission.

B. Show changes occurring since previous submission of schedule:

1. Major changes in scope.
2. Activities modified since previous submission.
3. Revised projections of progress and completion.
4. Other identifiable changes.
C. Provide a narrative report as needed to define:

1. Problem areas, anticipated delays, and the impact on the schedule.
2. Corrective action recommended, and its effect.
3. The effect of changes on schedules of other prime contractors.

D. If the Work falls behind the critical path schedule by 2 weeks or more, the Contractor shall prepare a recovery schedule.

E. Each updated schedule shall be accompanied by a signed statement from the Contractor identifying and describing all changes to logic, duration or activities made since the last schedule submission.

1.06 SUBMISSIONS

A. Submittal Requirements.

1. Logic network and/or time-phased, color bar chart, computer generated.
2. Computerized network analysis:
   a. Sort by early start for entire project and for each project phase.
   b. Sort by float for entire project and for each project phase.
   c. Sort by responsibility code.
   d. Sort by predecessor/successor.
3. Narrative description of the logic and reasoning of the schedule.

B. Time of Submittals.

Within 10 working days after Notice to Proceed, Contractor shall submit a network diagram describing the activities to be accomplished in the project and their dependency relationships, (predecessor/successor) as well as a tabulated schedule as herein defined. The total length of time indicated on the initial CPM schedule shall equal the exact number of days in the Contract Time. The schedule produced and submitted shall also indicate calendar dates, including project starting and completion dates, based on the Contract Commencement and completion dates indicated in the Notice to Proceed. The Engineer will complete the review of the complete schedule within 15 working days after receipt. During the review process, the Engineer may meet with a representative of Contractor to review the proposed plan and schedule to discuss any clarifications that may be necessary.

C. Within 10 working days after the conclusion of the Engineer's review period, Contractor shall revise the network diagram as required and resubmit the network diagram and a tabulated schedule produced therefrom. The revised network diagram and tabulated schedule shall be reviewed and accepted or rejected by the Engineer within 15 working days after receipt. The network diagram and tabulated schedule, when accepted by the Engineer, shall constitute the project work schedule unless a revised schedule is required due to
substantial changes in the Work, a change in Contract Time or a recovery schedule is required and requested.

D. Acceptance. The finalized schedule will be acceptable to the Engineer when, in the opinion of the Engineer, it demonstrates an orderly progression of the Work to completion in accordance with the Contract Documents. Such acceptance will neither impose on the Engineer responsibility for the progress or scheduling of the Work nor relieve Contractor from full responsibility therefore. The finalized schedule of shop drawing submittals will be acceptable to the Engineer when, in the opinion of the Engineer, it demonstrates a workable arrangement for processing the submittals in accordance with the requirements. The finalized Schedule of Values (lump sum price breakdown), as applicable, will be acceptable to the Engineer as to form and content when, in the opinion of the Engineer, it demonstrates a substantial basis for equitably distributing the Contract Price. When the network diagram and tabulated schedule have been accepted, the Contractor shall submit to the Engineer five (5) copies of the time-scaled network diagram, five (5) copies of a computerized tabulated schedule in which the activities have been sequenced by numbers, five (5) copies of a computerized tabulated schedule in which the activities have been sequenced by early starting date, and five (5) copies of a computerized, tabulated schedule in which activities have been sequenced by total float, and five (5) copies sorted by predecessor/successor and five (5) copies of computerized tabulated schedule in which activities have been sorted by phase then total float.

E. Revised Work Schedules. Contractor, if requested by the Engineer, shall provide a revised work schedule if, at any time, the Engineer considers the completion date to be in jeopardy because of “activities behind schedule.” The revised work schedule shall include a new diagram and tabulated schedule conforming to the requirements of Paragraph 1.09 herein, designed to show how Contractor intends to accomplish the Work to meet the completion date. The form and method employed by Contractor shall be the same as for the original work schedule. No payment will be made if activities fall more than two (2) weeks behind schedule and a revised work schedule is not furnished.

F. Schedule Revisions. The Engineer may require Contractor to modify any portions of the work schedule that become infeasible because of “activities behind schedule” or for any other valid reason. An activity that cannot be completed by its original latest completion date shall be deemed to be behind schedule. No change may be made to the sequence, duration, or relationships of any activity without approval of the Engineer.

1.07 CHANGE ORDERS

A. Upon approval of a change order, the approved changes shall be reflected in the next scheduled revision or update submittal of the construction progress schedule by the Contractor.
1.08 CPM STANDARDS

A. CPM, as required by this Section, shall be interpreted to be generally as outlined in the Associated General Contractors (AGC) publication, Construction Planning & Scheduling Manual, Copyright 1997.

B. Work schedules shall include a graphic network and computerized, tabulated schedules as described below. To be acceptable the schedule must demonstrate the following:

1. A logical succession of work from start to finish.

2. Definition of each activity. Activities shall be identified by phase and responsibility.

3. A logical flow of work crews/equipment.

4. Show all work activities and interfaces including submittals as well as major material and equipment deliveries.

C. Networks

1. The CPM network, or diagram, shall be in the form of a time-scaled diagram of the customary activity-on-type and may be divided into a number of separate pages with suitable notation relating the interface points among the pages. Notation on each activity line shall include a brief work description and a duration, as described in Paragraph 1.08, D. herein.

2. All construction activities and procurement shall be indicted in a time-scaled format, and a calendar shall be shown on all sheets along the entire sheet length. Each activity arrow shall be plotted so the beginning and completion dates of said activity can be determined graphically by comparison with the calendar scale. All activities shall be shown using the symbols that clearly distinguish between critical path activities, non-critical path activities, and float for each non-critical activity. All non-critical path activities shall show estimated performances time and float time in scaled form.

D. The duration indicated for each activity shall be in calendar days and shall represent the single best time considering the scope of the work and resources planned for the activity including time for inclement weather. Except for certain non-labor activities, such as curing concrete or delivering materials, activity durations shall not exceed 14 days nor be less than 1 day unless otherwise accepted by the Engineer.

E. Tabulated Schedules. The initial schedule shall include the following minimum data for each activity.

1. Activity Beginning and Ending Numbers (i-j numbers) (single activity numbers may be used).
2. Duration.
3. Activity Description.
4. Early Start Date (Calendar Dated).
5. Late Start Date (Calendar Dated).
6. Early Finish Date (Calendar Dated).
7. Late Finish Date (Calendar Dated).
8. Identified Critical Path.
9. Total Float (Note: No activity may show more than 20 days float).
10. Cost of Activity.

F. Project Information. Each tabulation shall be prefaced with the following summary data.

1. Project Name.
2. Contractor.
3. Type of Tabulation (Initial or Updated).
4. Project Duration.
5. Project Scheduled Completion Date.
6. Effective or Starting Date of the Schedule.
7. New Project Completion Date and Project Status (if an updated or revised schedule).
8. Actual Start Date and Actual Finish Date (for all updated schedules).

G. The impact on the Contract Time created by a change in logic or duration or by new activities associated with a change in the Contract Work is determined by the resulting change in the critical path.

1.09 SCHEDULE MONITORING AND UPDATE

A. At not less than monthly intervals or when specifically requested by Engineer, Contractor shall submit to the Engineer a computer printout of an updated schedule for those activities that remain to be completed. If requested by the Engineer, the update shall also include all activities, completed and uncompleted. Typically, the updated schedule will be submitted with the application for payment as specified below.

B. The updated schedule shall be submitted in the form, sequence, and number of copies requested for the initial schedule.

C. Each updated schedule shall be accompanied by a signed statement from the Contractor identifying and describing all changes to logic, duration or activities made since the last schedule submission.

1.10 PROGRESS MEETINGS

For the monthly progress meeting, Contractor shall submit a revised CPM schedule and a 3 week look-ahead schedule, showing all activities completed, in progress, uncompleted, or scheduled to be worked during the weeks. The 3 weeks include the current week plus the next 2 weeks. All activities shall be from the approved CPM and must be as shown on the CPM unless behind or ahead of schedule. One (1) copy of the
revised CPM schedule shall be submitted with each copy of that month's application for payment, four (4) copies minimum.

PART 2 - PRODUCTS (not used)

PART 3 - EXECUTION (not used)

END OF SECTION
PART 1 - GENERAL

1.01 SECTION INCLUDES

Requirements and procedures for structural, architectural, mechanical and electrical coordination to ensure proper selection, installation, fit and operation of all mechanical, electrical and control devices as well as building components. This coordination includes materials and equipment supplied by the Owner for installation by the Contractor.

1.02 COORDINATOR

Contractor shall employ an individual or a firm, technically qualified and experienced in field coordination for the type of work required for this Project for the duration of the Work.

1.03 SUBMITTALS

A. General: As specified in Section 01330 – Submittals.

B. Submit name, address, and telephone number of Coordinator and, if a firm, the name of its principal officer, to Engineer for approval.

C. Submit necessary coordination drawings and schedules prior to submitting shop drawings, product data, and samples.

1.04 COORDINATION REQUIRED

A. Coordinate submittals for Owner Furnished Equipment as well as structural, architectural, mechanical and electrical products.

B. Conduct conferences with Subcontractors and others concerned with the Work, to establish and maintain coordination and schedules, and to resolve coordination matters in dispute.

C. Participate in progress meetings. Report on progress of Work to be adjusted under coordination requirements, and any required changes in schedules. Transmit official minutes of meetings and reports to concerned parties.

1.05 DOCUMENTS FOR COORDINATION

A. Prepare necessary coordination drawings to organize installation of products for efficient use of available space, to meet requirements of Work sequence, for proper sequence of installation, and to identify potential conflicts.
B. Prepare a master schedule to identify responsibilities under each section of Divisions 1 through 17 of the Specifications for activities that directly relate to mechanical and electrical coordination, including submittals and temporary utilities.

C. Maintain documents for the duration of the Work, recording changes due to site restrictions, modifications or adjustments.

D. After Engineer review of original and revised documents, reproduce and distribute copies to concerned parties.

1.06 COORDINATION OF SUBMITTALS

A. Coordinate shop drawings, product data, and samples.
   1. Check field dimensions and clearances and relationship to available space and anchors.
   2. Check compatibility of products with products furnished or installed under other sections.
   3. Check electrical characteristics, and operational control requirements.
   4. Check motor voltages, speed, and control characteristics.
   5. Coordinate controls, interlocks, power wiring, control wiring, and instrument wiring.
   6. Coordinate wiring and control diagrams.
   7. Review the effect of any changes on work of other sections.

B. Verify and coordinate maintenance of Record Documents.

1.07 COORDINATION OF SUBSTITUTIONS AND MODIFICATIONS

A. Submit requests for substitutions as specified in Section 01600 – Materials and Equipment.

B. Review proposals and requests from subcontractors.

C. Verify compatibility of substitutes with other products. Identify modifications required to make other products compatible with substitutes.

PART 2 - PRODUCTS (not used)

PART 3 - EXECUTION

3.01 OBSERVATION OF WORK

A. Observe Work for structural, architectural, mechanical and electrical coordination.
B. Maintain a list of observed deficiencies and defects and promptly report observed deficiencies and defects to appropriate parties.

3.02 EQUIPMENT START-UP

A. Verify utilities, connections and controls are complete and equipment is in operable condition prior to equipment start-up.

B. Observe start-up of equipment and demonstrations to Owner.

C. Coordinate adjustments or modifications required to provide equipment and systems that operate properly, both mechanically and electrically.

3.03 INSPECTION AND ACCEPTANCE OF EQUIPMENT

Prior to inspection, verify that equipment and systems are tested and operating properly.

END OF SECTION
SECTION 01330

SUBMITTALS

PART 1 - GENERAL

1.01 SECTION INCLUDES

Requirements and procedures for submittals.

1.02 SCHEDULE

A. Transmit submittals in accordance with approved Progress Schedule, and in such sequence to avoid delay in the Work or work of other contracts.

B. Do not fabricate products or begin work that requires submittals until return of submittal with Engineer acceptance.

C. Identify the appropriate specification sections and parts on each submittal.

1.03 CONTRACTOR REVIEW

A. Review submittals prior to transmittal; determine and verify field measurements, field construction criteria, manufacturer's catalog numbers, and conformance of submittal with requirements of Contract Documents.

B. Sign each sheet of shop drawings and product data, and each sample; label to certify compliance with requirements of Contract Documents. Notify Engineer of any deviations from requirements of Contract Documents in writing at time of submittal.

C. Identify the relevant specification sections and parts on each submittal.

1.04 SUBMITTAL REQUIREMENTS

A. Apply Contractor's stamp, signed certifying to review and approval, verification of products, field dimensions and field construction criteria, and coordination of information with requirements of Work and Contract Documents.

B. Number each submittal sequentially beginning with 001. Each submittal shall describe only one product or equipment. Re-submittals shall use the same number identifier with a letter suffix; e.g. 001A. Submittals shall identify the relevant Specifications Section(s).

C. Coordinate submittals into logical groupings to facilitate interrelation of the several items:

1. Finishes that involve Engineer selection of colors, textures, or patterns.

2. Associated items that require correlation for efficient function or for installation.
D. Submit under transmittal letter. Identify Project by title and number.

E. If any submittal requires more than three reviews (normally an original and two re-
submittals), the Engineer may charge the Contractor for additional review time based on his actual incurred time and expenses. These charges shall be summarized for the Contractor and deducted from the Contractor's next pay request.

F. The Contractor may expect most submittals to be reviewed within 21 calendar days following receipt of the submittal. Certain submittals such as Owner color selection or instrumentation may require a longer review time.

G. The submission of submittals by email may be allowed on a limited basis only subject to prior specific approval by the Engineer. Email shall not be used for transmission of the following submittals: (a) construction schedules, (b) electrical submittals, (c) instrumentation submittals, (d) structural submittals, (e) any submittal over two pages in length and (f) any submittal in color.

H. Shop drawings, product datasheets and samples shall be submitted for approval on all materials, components and systems for all civil/site, structural, architectural, mechanical, process, HVAC, electrical and instrumentation work. Submittals shall also be provided as described in the Contract Documents.

1.05 NUMBER OF COPIES

A. Minimum Number of Copies: Submit minimum number of copies as follows:

<table>
<thead>
<tr>
<th>Submittal</th>
<th>To Engineer</th>
<th>Returned to Contractor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Schedule of Submittals</td>
<td>5 copies</td>
<td>1 copy</td>
</tr>
<tr>
<td>Progress Schedules</td>
<td>5 copies</td>
<td>1 copy</td>
</tr>
<tr>
<td>Shop Drawings &amp; Product Data</td>
<td>8 copies</td>
<td>3 copies</td>
</tr>
<tr>
<td>Crane Placement Drawings (site specific)</td>
<td>3 each</td>
<td>1 each</td>
</tr>
<tr>
<td>Test Reports and Samples</td>
<td>3 copies</td>
<td>1 copy</td>
</tr>
<tr>
<td>Certificates of Compliance</td>
<td>3 copies</td>
<td>--</td>
</tr>
<tr>
<td>Operation and Maintenance Data</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Draft</td>
<td>3 copies</td>
<td>2 copies</td>
</tr>
<tr>
<td>Final</td>
<td>6 copies</td>
<td>--</td>
</tr>
</tbody>
</table>
B. Additional Copies: If additional copies of shop drawings, product data, or shop drawings and product data are required by the Contractor, submit up to two additional copies to Engineer.

1.06 SCHEDULE OF SUBMITTALS

A. Submit copies of Preliminary Schedule of Submittals prior to the Preconstruction Conference.

B. Within 10 days after Preconstruction Conference, submit the revised copies of Schedule of Submittals

1.07 PROGRESS SCHEDULES

Submit progress schedules in accordance with Contract documents

1.08 SHOP DRAWINGS

A. Present in a clear and thorough manner. Title each drawing with Project name and number. Transmittal letter shall reference item as listed on Submittal Schedule.

B. Identify each element of drawings by reference to sheet number and specification section of Contract Documents.

C. Identify field dimensions; show relation to adjacent or critical features or Work or products.

D. Submit outline of manufacturer's representative services with Shop Drawings. Outline of manufacturer's representative services shall include man-hours or man-days of service to be provided for each of the following:

1. Minimum man-hours or man-days of service to be provided for installation inspection, assistance, and certification.

2. Minimum man-hours or man-days of service to be provided for functional testing and start-up.

3. Minimum man-hours or man-days of service to be provided for training Owner's operation and maintenance personnel.

4. Outline of manufacturer's representative services shall identify services and minimum man-hours, or minimum man-days, to be provided by factory representative and by equipment supplier, or distributor.
E. Provide a Spare Parts List including both the spare parts recommended by the equipment manufacturer for the first year of service and any spare parts specified in the individual specification sections.

1.09 PRODUCT DATA

A. Submit only pages that are pertinent. Mark or highlight each copy of standard printed data to identify pertinent products. Show reference standards, performance characteristics, and capacities; wiring and piping diagrams and controls; component parts; finishes; dimensions; and required clearances.

B. Modify manufacturer's standard schematic drawings and diagrams to supplement standard information and to provide information specifically applicable to the Work. Delete information not applicable.

1.10 SAMPLES

A. Submit full range of manufacturer's standard finishes except when more restrictive requirements are specified, indicating colors, textures, and patterns, for Owner selection.

B. Submit samples to illustrate functional characteristics of products, including parts and attachments.

C. Approved samples that may be used in the Work are indicated in the Specification section.

D. Label each sample with identification required for transmittal letter.

E. Provide field samples of finishes at Project, at location acceptable to Engineer, as required by individual Specifications section. Install each sample complete and finished. Acceptable finishes in place may be retained in completed work.

F. Accepted samples shall establish the standards by which the completed Work will be judged.

1.11 TEST REPORTS

Submit test reports as specified in Section 01430 – Materials Testing

1.12 CERTIFICATES OF COMPLIANCE

A. Submit Manufacturer’s Affidavits of Compliance as specified in Section 01600 – Materials and Equipment.

B. Submit Manufacturer’s Certificate of Compliance as specified in Section 01750 – Testing and Start Up.

1.13 OPERATION AND MAINTENANCE DATA
A. Submit operation and maintenance data as specified in Section 01830 – Operation and Maintenance Data.

1.14 LUBRICATION TEST

Submit results of lubricant testing as specified in Section 01600 – Materials and Equipment.

1.15 SUBSTITUTIONS

Submit requests for substitutions as specified in section 01600 – Materials and Equipment.

1.16 REQUESTS

If there are any questions about interpretations of plans, specifications or Contract Documents, the Contractor may submit a written request for information or a request for clarification to the Engineer.

1.17 RESUBMITTAL

A. Make resubmittals under procedures specified for initial submittals; identify changes made since previous submittal.

B. Identify resubmittal as a resubmittal and reference previous submittal.

C. Identify changes made since previous submittal.

1.18 DISTRIBUTION

A. Distribute reproductions of shop drawings, copies of product data, samples, substitutions and other submittals which bear Engineer's review stamp, to job site file, Record Documents file, subcontractors, suppliers, and other entities requiring information.

B. Instruct recipients to promptly report any inability to comply with provisions.

PART 2 - PRODUCTS (not used)

PART 3 - EXECUTION (not used)

END OF SECTION
PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

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

1. Testing and inspecting services shall be performed by independent testing agencies.

B. Referenced Standards: If compliance with two or more standards is specified and the standards establish different or conflicting requirements, comply with the most stringent requirement. Refer uncertainties to Engineer for a decision.

C. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum. The actual installation may exceed the minimum within reasonable limits. Indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Engineer for a decision.

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

1. Date of issue.
2. Project title and number.
3. Name, address, and telephone number of testing agency.
4. Dates and locations of samples and tests or inspections.
5. Record of temperature and weather conditions at time of sample taking and testing and inspecting.
6. Names of individuals making tests and inspections.
7. Description of the Work and test and inspection method.
8. Complete test or inspection data, test and inspection results, an interpretation of test results, and comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
9. Name and signature of laboratory inspector.
10. Recommendations on retesting and re-inspecting.

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

F. Testing Agency Qualifications: An independent agency with the experience and capability to conduct testing and inspecting indicated; and where required by authorities having jurisdiction, that is acceptable to authorities. The testing agency shall be paid by the Contractor.
G. Retesting/Reinspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and reinspecting, for construction that replaced Work that failed to comply with the Contract Documents.

H. Testing Agency Responsibilities: Cooperate with Engineer and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.
   1. Promptly notify Engineer and Contractor of irregularities or deficiencies in the Work observed during performance of its services.
   2. Do not release, revoke, alter, or increase requirements of the Contract Documents or approve or accept any portion of the Work.
   3. Do not perform any duties of Contractor.

I. Associated Services: Cooperate with testing agencies and provide reasonable auxiliary services as requested. Provide the following:
   1. Access to the Work.
   2. Incidental labor and facilities necessary to facilitate tests and inspections.
   3. Adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.
   4. Facilities for storage and field curing of test samples.
   5. Security and protection for samples and for testing and inspecting equipment.

J. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and -control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.
   1. Schedule times for tests, inspections, obtaining samples, and similar activities.

K. Special Tests and Inspections: Conducted by a qualified testing agency as required by authorities having jurisdiction, as indicated in individual Specification Sections and as indicated on the Drawings.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION
SECTION 01410
REGULATORY REQUIREMENTS

PART 1 - GENERAL

1.01 SECTION INCLUDES

Requirements and procedures for obtaining permits and complying with permits.

1.02 PERMITS

A. Contractor will obtain County, State and Federal permits not obtained by County, including but not limited to building permits, South Florida Water Management District dewatering permits, right-of-way permits, burning permits, tree removal permits, excavation permits, demolition permits and Florida Dept. of Environmental Protection NPDES Stormwater Pollution Prevention Plan.

B. The Contractor must file a minimum of 48 hours prior to start of construction a Notice of Intent with the DEP.

C. Contractor shall schedule and document all inspections and re-inspections (if needed) required by permitting agencies.

D. The Owner will obtain the DEP Permit, and County zoning utilities and engineering approvals.

E. Documents:

1. County will furnish signed and sealed sets of Contract Documents for permit applications.

2. County will furnish copies of permits obtained by County and required to be posted on the job site. Copies of permits will be forwarded to Contractor prior to start of construction.

3. Contractor shall furnish copies of permits obtained by the Contractor. Forward copies of permits to the County prior to commencement of work requiring permits.

1.03 CODES AND ORDINANCES

A. Codes applicable to this project include, but are not necessarily limited to, the following:

1. Standard building codes as applicable.

2. Title 29, Part 1926, Construction Safety and Health Regulations, Code of Federal Regulations (OSHA), including all changes and amendments thereto.

4. Accessibility Requirements Manual, Department of Community Affairs, Florida Board of Building Codes and Standards.


B. All materials and workmanship shall confirm to local city or county ordinances.

C. If there is a conflict in regulations, codes, or regulations and codes, the more stringent requirements shall govern.

**PART 2 - PRODUCTS (not used)**

**PART 3 - EXECUTION**

3.01 **VERIFICATION AND CONFORMANCE**

A. Conform to all requirements of all permits.

**END OF SECTION**
SECTION 01420
REFERENCE STANDARDS

PART 1 - GENERAL

1.01 SECTION INCLUDES

Description of reference standards and requirements relative to reference standards.

1.02 QUALITY CONTROL

For products or workmanship specified by association, trade, or Federal Standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.

1.03 REFERENCE PUBLICATIONS

A. The date of reference publications shall be the latest in effect at the time of the award of Contract.

B. Reporting and resolving discrepancies relative to reference publications shall be as specified in the General Conditions and Division 1 of the specifications.

C. Document precedence shall be as specified in the General Conditions.


1.04 SCHEDULE OF STANDARDS ORGANIZATIONS

AA    Aluminum Association
AAMA   Architectural Aluminum Manufacturer's Association
AAN    American Association of Nurserymen, Inc.
AASHTO American Association of State Highway and Transportation Officials
ACI    American Concrete Institute
ACPA   American Concrete Pipe Association
AFBMA  Anti-Friction Bearing Manufacturer's Association, Inc.
AGC    Associated General Contractors of America
AGMA   American Gear Manufacturer's Association
AHDGA  American Hot Dip Galvanizers Association
<table>
<thead>
<tr>
<th>Acronym</th>
<th>Full Name</th>
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<tbody>
<tr>
<td>AI</td>
<td>Asphalt Institute</td>
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<tr>
<td>AIA</td>
<td>American Institute of Architects</td>
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<tr>
<td>AISC</td>
<td>American Institute of Steel Construction</td>
</tr>
<tr>
<td>AISI</td>
<td>American Iron and Steel Institute</td>
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<tr>
<td>AITC</td>
<td>American Institute of Timber Construction</td>
</tr>
<tr>
<td>AMCA</td>
<td>Air Moving and Conditioning Association</td>
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<tr>
<td>ANSI</td>
<td>American National Standards Institute</td>
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<td>APA</td>
<td>American Plywood Association</td>
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<td>API</td>
<td>American Petroleum Institute</td>
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<td>APHA</td>
<td>American Public Health Association</td>
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<td>American Public Works Association</td>
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<td>AREA</td>
<td>American Railway Engineering Association</td>
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<td>ASA</td>
<td>Acoustical Society of America</td>
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<td>ASAE</td>
<td>American Society of Agricultural Engineers</td>
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<tr>
<td>ASCE</td>
<td>American Society of Civil Engineers</td>
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<tr>
<td>ASHRAE</td>
<td>American Society of Heating, Refrigerating, and Air-Conditioning Engineers</td>
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<tr>
<td>ASLE</td>
<td>American Society of Lubricating Engineers</td>
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<tr>
<td>ASME</td>
<td>American Society of Mechanical Engineers</td>
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<tr>
<td>ASMM</td>
<td>Architectural Sheet Metal Manual</td>
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<tr>
<td>ASTM</td>
<td>American Society for Testing and Materials</td>
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<tr>
<td>AWPA</td>
<td>American Wood-Preservers' Association</td>
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<tr>
<td>AWPI</td>
<td>American Wood Preservers Institute</td>
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<tr>
<td>AWWA</td>
<td>American Water Works Association</td>
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<tr>
<td>AWS</td>
<td>American Welding Society</td>
</tr>
<tr>
<td>BHMA</td>
<td>Builders Hardware Manufacturer's Association</td>
</tr>
<tr>
<td>CMA</td>
<td>Concrete Masonry Association</td>
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</table>
CRSI  Concrete Reinforcing Steel Institute
DEP  Florida Department of Environmental Protection
DIPRA  Ductile Iron Pipe Research Association
EIA  Electronic Industries Association
EJCDC  Engineers' Joint Contract Documents Committee
EIA  Environmental Protection Agency
ETL  Electrical Test Laboratories
FDEP  Florida Department of Environmental Protection
FDOT  Florida Department of Transportation
FS  Federal Specification General Services Administration Specification and Consumer Information Distribution Section (WFSIS)
HI  Hydraulic Institute
IEEE  Institute of Electrical and Electronics Engineers
IES  Illuminating Engineering Society
IMIAC  International Masonry Industry All-Weather Council
IPCEA  Insulated Power Cable Engineers Association
ISA  Instrument Society of America
ISO  International Organization for Standardization
MBMA  Metal Building Manufacturer's Association
MTI  Marine Testing Institute
NAAMM  National Association of Architectural Metal Manufacturers
NACE  National Association of Corrosion Engineers
NBS  National Bureau of Standards
NEC  National Electric Code
NEMA  National Electrical Manufacturers' Association
NFPA  National Fire Protection Association
NRCA  National Roofing Contractor's Association
OSHA  Occupational Safety and Health Administration, Federal Department of Labor
PCA  Portland Cement Association
SBC  Standard Building Code
SDI  Steel Door Institute
SJI  Steel Joist Institute
SMACCNA  Sheet Metal and Air Conditioning Contractors National Association
SSPC  Steel Structures Painting Council
UL  Underwriter's Laboratories, Inc.
WEF  Water Environment Federation

PART 2 - PRODUCTS (not used)

PART 3 - EXECUTION (not used)

END OF SECTION
SECTION 01430
MATERIALS TESTING

PART 1 - GENERAL

1.01 SECTION INCLUDES

Requirements and procedures for testing laboratory services for soils, grout, concrete, masonry, asphalt and other materials and equipment as required by the Contract Documents.

1.02 REFERENCES

A. General: as specified in Section 01420 - Reference Standards.

B. ANSI/ASTM Standards

1. ANSI/ASTM D3740 Practice for Evaluation of Agencies Engaged in Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction

2. ANSI/ASTM E329 Practice for Inspection and Testing Agencies for Concrete, Steel, Bituminous Materials as Used in Construction

1.03 SELECTION AND PAYMENT

A. The Contractor shall employ services of an independent testing laboratory to perform specified inspection and testing.

B. Employment of testing laboratory shall in no way relieve Contractor of obligation to perform work in accordance with requirements of Contract Documents.

1.04 QUALITY ASSURANCE

A. Standards: 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 Professional Engineer on staff to review services.

D. Testing Equipment: Calibrated at reasonable intervals with devices of accuracy traceable to either National Bureau of Standards (NBS) Standards or accepted values of natural physical constants.

1.05 LABORATORY RESPONSIBILITIES

A. Test samples submitted by Contractor.
B. Provide qualified personnel at site. Cooperate with Engineer 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 Engineer and Contractor of observed irregularities or non-conformance of Work or Products.

F. Perform additional inspections and tests required by Engineer.

G. Attend preconstruction conferences and progress meetings as appropriate.

1.06 LABORATORY REPORTS

A. After each inspection and test, the laboratory shall promptly submit three (3) copies of laboratory report to Engineer and Contractor.

B. Report shall include:

1. Date issued,
2. Project title and number,
3. Name of inspector or technician,
4. Date 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,

C. When requested by Engineer, provide interpretation of test results.

1.08 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.

1.09 CONTRACTOR RESPONSIBILITIES
A. Deliver to laboratory, at designated location, adequate samples of proposed materials that require testing, along with proposed design data as required.

B. Cooperate with laboratory personnel, and provide access to the Work.

C. 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.

D. Notify Engineer and laboratory 24 hours prior to expected time for operations requiring inspection and testing services.

E. Payment for testing and laboratory services.

1.10 SCHEDULE OF INSPECTIONS AND TESTS

As specified in individual Product Specification sections

PART 2 - PRODUCTS (not used)

PART 3 - EXECUTION (not used)

END OF SECTION
PART 1 - GENERAL

1.01 SECTION INCLUDES

Requirements to ensure that the products and installation meet industry standards, manufacturer’s requirements and government regulations and ordinances.

1.02 GENERAL QUALITY CONTROL

A. The Contractor shall maintain quality control over suppliers, manufacturers, products, services, site conditions, and workmanship to produce work of specified quality.

B. Public Inspection: The Contractor shall inform the Engineer and local authorities, such as building and plumbing inspectors, Fire Marshall, OSHA inspectors, and others in order that they may approve all required work and witness all required tests for foundations, piping, plumbing, fire protection systems, pressure vessels, safety systems, electrical systems and other systems requiring regulatory authority inspections to obtain all required permits and certificates.

C. Site Inspection: The Contractor shall verify all dimensions in the field and shall continuously check field conditions during construction.

D. Sampling and Testing: The Engineer reserves the right to take samples and make independent tests to verify that the Work meets the requirements of the specifications.

1.03 RIGHT OF REJECTION

A. Engineer shall have the right, at all times and places, to reject any articles or materials to be furnished hereunder which, in any respect, fail to meet the requirements of the Contract Documents, regardless of whether the defects in such articles or materials are detected at the point of manufacture or after installation. If the Engineer or its representative, through an oversight or otherwise, has accepted materials or Work which is defective or which is contrary to the Contract Documents, such materials, no matter in what stage or condition of manufacture, delivery, or erection, may be subsequently rejected.

B. The Contractor shall promptly remove rejected articles or materials from the site of the Work after notification of rejection.
PART 2 – PRODUCTS

2.01 MANUFACTURER’S CERTIFICATES

Submit manufacturer’s certificate that product meets or exceeds specified requirements as specified in Section 01600 – Material and Equipment and Section 01750 – Testing and Startup.

2.02 MATERIALS TESTING

The Contractor shall employ the services of an independent, testing laboratory to perform inspections, tests, and other services as specified in Section 01430 – Materials Testing. The Contractor’s responsibilities are described in Section 01430.

PART 3 - EXECUTION

3.01 MANUFACTURER’S INSTRUCTIONS

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

3.02 WORKMANSHIP

A. Comply with industry standards except when more restrictive tolerances or specified requirements indicate more rigid standards or more precise workmanship.

B. Comply with all local, state and federal regulations and ordinances.

C. Perform work by persons qualified to produce workmanship of specified quality.

D. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration and rocking.

3.03 MANUFACTURER’S FIELD SERVICES

A. When specified in the individual product section, require manufacturer or manufacturer’s representative to provide qualified personnel to observe field conditions; conditions of surfaces and installation; quality of workmanship; start-up, testing, adjustment, and balance of equipment as applicable; and to make appropriate recommendations.

B. The extent of the manufacturer’s field services shall be as specified in the individual product specification sections.

END OF SECTION
SECTION 01470
COLOR AUDIO-VIDEO PRECONSTRUCTION RECORD

PART 1 - GENERAL

1.01 SCOPE

Prior to commencing work, the Contractor shall take a continuous color audio-video digital DVD recording of Project site to serve as a record of pre-construction conditions. The recording shall cover all areas of Contract Work and areas intended for Field offices, material and equipment storage.

1.02 APPROVAL

No construction shall begin prior to review and approval by Engineer of the DVD recording covering construction area. The Engineer shall have authority to reject all or any portion of the recording not conforming to specifications and order that it be done again at no additional charge. The Contractor shall reschedule unacceptable coverage within five days after being notified. The Engineer shall designate those areas, if any, to be omitted from or added to the audio-video coverage. Recordings shall not be made more than 60 days prior to construction in any area. All DVDs and written records shall become property of the County. Prior to video recording, there will be a meeting between Engineer, Contractor and electrographer.

1.03 PROFESSIONAL ELECTROGRAPHERS

Engage the services of a professional electrographer. The color audio-video recording shall be prepared by a responsible commercial firm known to be skilled and regularly engaged in the business of preconstruction color audio-video documentation. The electrographer shall furnish to Engineer a list of names and addresses of two references that electrographer has performed color audio-video recording for projects of a similar nature.

PART 2 - PRODUCTS

2.01 AUDIO-VIDEO DVDs

Audio-video DVDs shall be new as manufactured by Maxell or equal. Reprocessed disks will not be acceptable. The Contractor shall submit two copies of each DVD recording for review and approval.

2.02 EQUIPMENT

A. Furnish all equipment, accessories, materials and labor to perform this service. The total audio-video system shall reproduce bright, sharp, clear pictures with accurate colors and shall be free from distortion, tearing, rolls or any other form of imperfection. The audio portion of the recording shall reproduce the
commentary of the camera operator with proper volume, clarity and be free from distortion and interruptions.

B. The color video camera used in the recording system shall have a horizontal resolution of 300 lines at center, a luminance signal to noise ratio of 45 dB and a minimum illumination requirement of 25 foot-candles.

PART 3 - EXECUTION

3.01 SCHEDULING

No recording shall be done during precipitation, mist or fog. Recording shall only be done when sufficient sunlight is present to properly illuminate the subjects of recording and to produce bright, sharp video recordings of those subjects.

3.02 RECORDED INFORMATION – AUDIO

Each recording shall begin with current date, project name and Owner and followed by general location, i.e., viewing side and direction of progress. Audio track shall consist of an original live recording. Recording shall contain the narrative commentary of electrographer, recorded simultaneously with his fixed elevation video record of the zone of influence of construction.

3.03 RECORDED INFORMATION - VIDEO

All video recordings must, by electronic means, display continuously and simultaneously generated with the actual taping transparent digital information to include the date and time of recording, and station numbers as shown on the Drawings. Date information shall contain the month, day and year. Time information shall contain the hour, minutes and seconds. Additional information shall be displayed periodically. Such information shall include but not be limited to project name, contract number, name of street or structure, direction of travel and view. This transparent information shall appear on the extreme upper left hand third of the screen.

3.04 AREA OF COVERAGE

A. Recorded coverage shall include all surface features located within the zone of construction supported by appropriate audio coverage. Such coverage shall include special attention to existing driveways, sidewalks, curbs, pavements, structures, exposed piping, electrical and control devices, landscaping, culverts, fences, signs and headwalls within the area covered.

B. When a conventional wheeled vehicle is appropriate for use, distance from the camera lens to the ground shall not be less than twelve feet. Rate of speed in the general direction of travel of the vehicle used during recording shall not exceed 15 feet per minute. Panning, zoom-in and zoom-out rates shall be sufficiently controlled to maintain a clear view of the object. Tape coverage may be required in areas not accessible by vehicles. Such coverage shall be obtained by walking or special conveyance approved by the Engineer.

END OF SECTION
SECTION 01510
TEMPORARY UTILITIES

PART 1 - GENERAL

1.01 SECTION INCLUDES

Requirements for temporary utilities.

1.02 TEMPORARY SERVICES

A. Each temporary service shall meet the requirements of the utility having authority over the temporary service. Provide metering and isolation to meet requirements of utility authority over temporary service.

B. Obtain permission of utility having authority over temporary service prior to connecting temporary service.

C. Remove temporary services after temporary services are no longer needed for construction operations, site security, field offices, or testing. Restore to pre-construction condition.

1.03 APPLICATION AND PAYMENT FOR TEMPORARY SERVICES

A. Make applications and arrangements and pay all fees and charges for temporary electrical, potable water, non-potable water, sanitary and telephone services.

B. Provide and pay for temporary generators, pumps, wiring, switches, piping, connections, meters, and appurtenances for temporary utilities.

C. The following permanent utility services and services relative to temporary utilities shall be provided by the Owner.

1. Electricity for facilities that are occupied and operated by the Owner.
2. Potable water for facilities that are occupied and operated by the Owner.
3. Telephone service for facilities that are occupied and operated by the Owner.

1.04 UTILITIES TO BE PROVIDED FOR OTHERS

A. The Contractor shall provide sanitary facilities for up to six field personnel associated with the Owner supplied equipment.

B. The Contractor shall supply electrical service including power use by field personnel associated with the Owner supplied equipment. It is anticipated the electrical service will not exceed four 120 volt, 30 amp outlets located near the installation point of the Owner supplied equipment.
1.05 ELECTRICITY, LIGHTING

A. For facilities connected to permanent electrical services, the Contractor shall pay the Owner by deductive cost Change Order for all electrical power used in new facilities until facility is accepted, occupied, and operated by the Owner.

B. Provide temporary electrical service, or services, for the following:
   1. Power tools for construction operations.
   2. Construction lighting.
   4. Field offices and sheds.
   5. Testing specified in individual Sections.

C. Provide construction lighting as required for the following:
   1. Prosecution of Work;
   2. Observation of Work by Engineer, Owner, and regulatory authorities;
   3. Access to facilities occupied by Owner within project site.

D. Wiring for Temporary Electrical Services
   1. Properly install and maintain wiring for temporary lighting and power.
   2. Provide separate circuits for temporary lighting and for temporary power.
   3. Provide branch wiring and distribution boxes located to allow service and lighting by means of construction-type power cords.
   4. Securely fasten wiring and electrical devices.
   5. Temporary lighting and power facilities shall meet the requirements of OSHA Safety and Health Standards for Construction.

1.06 WATER

A. Provide temporary water services for the following:
   1. Potable water or non-potable water for construction operations.
   2. Potable water for consumption by Contractor's and subcontractors' personnel.
   3. Potable water for field offices.
   4. Potable water or non-potable water for fire protection on the construction site.

B. Piping for Temporary Water Services
   1. Provide pipe, fittings, valves, and hydrants for temporary water service, or services.
2. Provide temporary pumps, storage tanks, and controls if available water volume, pressure, or volume and pressure are not sufficient for construction operations.
3. Extend branch piping with outlets located so that water is available by use of hoses.
4. Securely anchor and support temporary water piping.
5. Provide warning signs at each temporary non-potable water outlet.

1.07 SANITARY FACILITIES

A. Provide sanitary facilities (fixed toilets or portable chemical toilets) for Contractor’s and subcontractor personnel.
B. Provide sanitary drain connection from Engineer’s Field Office or provide holding tank with weekly pump-outs.
C. Sanitary Facilities for Contractor's and Subcontractor Personnel shall meet the requirements of OSHA Safety and Health Standards for Construction.
D. Seclude sanitary facilities from public observation as follows:
   1. Locate sanitary facilities so that sanitary facilities cannot be observed by public, or
   2. Provide screening around sanitary facilities so that public cannot observe sanitary facilities.
E. Maintain sanitary facilities so that sanitary facilities are clean and dry at all times.
F. Enforce use of sanitary facilities. Do not commit nuisances on the project site.

1.08 HEAT, VENTILATION, AND AIR CONDITIONING

A. Provide temporary heat, ventilation, and air conditioning for the following:
   1. Construction operations.
   2. Protection, drying, and curing of materials and finishes.
   3. Field offices and sheds.
B. Temporary heat and ventilation for construction operations shall meet the requirements of OSHA Safety and Health Standards for Construction.

1.09 TELEPHONE SERVICE

A. Provide temporary, land line telephone service for the following:
   1. Communications regarding construction operations.
   2. Emergency services.
   3. Field offices.
PART 2 - PRODUCTS (not used)

PART 3 - EXECUTION (not used)

END OF SECTION
PART 1 - GENERAL

1.01 SECTION INCLUDES

Requirements for site occupancy.

1.02 CONTRACTOR USE OF PROJECT SITE

A. Contractor’s use of project site shall be limited to the Contractor’s construction operations, including on-site storage of materials, and field offices.

B. The Contractor shall prepare shop drawing submittal showing the location of trailers, utilities, storage parking, and staging area. No occupancy of the existing facility will be allowed until this submittal has been approved by the Engineer.

C. The Contractor shall not operate any valve, flow control device, electrical device, instrument or control system associated with the existing facility. If such operation is required for prosecution of the Work, the Contractor shall notify the Owner. Only the Owner’s representatives or staff shall operate such devices.

D. Residential occupancy on the project site by the Contractor’s or subcontractor’s employees, including owners and supervisors, is not permitted.

1.03 OWNER USE OF PROJECT SITE

A. Owner may utilize all or part of the existing facilities during the entire construction period for the conduct of the Owner’s normal operations.

B. Schedule and coordinate the Work to minimize interference between construction operations and Owner’s operation and maintenance of facilities in service.

1.04 OPERATION AND MAINTENANCE OF TREATMENT FACILITIES

A. Operation

1. Owner shall operate the treatment facilities that are in service as part of the treatment process.

2. Contractor shall operate or assist in the operation of new facilities and modified facilities during testing and prior to Owner’s acceptance of new facilities and modified facilities.

B. Maintenance
1. Owner shall maintain existing facilities that have not been removed from service for modification or demolition.

2. Owner shall maintain new facilities and modified facilities that have been accepted following Substantial Completion certification of these facilities by the Engineer.

3. New or modified facilities shall be placed in service prior to acceptance if required to meet regulatory requirements for treatment quality. New or modified facilities may be placed in service prior to acceptance if required to complete Work on schedule. If new facilities or modified facilities are in service prior to acceptance of new or modified facilities, Contractor shall maintain new or modified facilities until such facilities are accepted for Substantial Completion. Contractor shall provide maintenance and operation at no additional cost to the Owner.

PART 2 - PRODUCTS (not used)

PART 3 - EXECUTION (not used)

END OF SECTION
PART 1 - GENERAL

1.01 SECTION INCLUDES

Requirements for field offices, storage areas, and sheds.

1.02 REQUIREMENTS FOR FIELD OFFICES AND SHEDS

A. Engineer's Field Office and Parking:
   1. One office as specified in this Section;
   2. Minimum of two parking spaces adjacent to Engineer's office.

B. Contractor's Field Office and Parking:
   1. Minimum of one office for Contractor's field superintendent and staff as specified in this Section;
   2. Minimum of two parking spaces adjacent to Contractor's field office.

C. Meeting Area and Parking:
   1. Minimum of one meeting area as specified in this Section;
   2. Minimum of two additional parking spaces adjacent to meeting area.

D. Storage Areas and Sheds: As required to hold and protect the following:
   1. Products and materials to be incorporated into new Work;
   2. Construction equipment and materials.

1.03 USE OF EXISTING AND PERMANENT FACILITIES

Do not use existing or permanent facilities for field offices or for storage.

1.04 CONTRACTOR'S AND ENGINEER'S FIELD OFFICES

A. Schedule for Contractor's and Engineer's Field Offices:
   1. Offices for Contractor and Engineer shall be complete before Contractor starts construction work on project site.
   2. Offices including temporary utilities and services, shall remain until new and renovated facilities are complete, tested, and accepted.
   3. Subcontractors' offices may be installed and removed to meet the requirements of the construction schedule.
B. Location of field offices: Install the offices within the designated staging area or as approved in the submittal for site occupancy. See Section 01520 - Occupancy.

C. Access to field offices:
1. Office and parking shall be accessible by passenger vehicle.
2. Provide steps and landing at each exterior entrance which is more than eight inches above grade. Steps and landings shall meet the requirements of the Life Safety Code.

D. Occupancy of Engineer’s Field Office:
1. Engineer’s field office shall be separate from Contractor’s or subcontractors’ field office, or offices.
2. Provide field office for sole use of Engineer.

E. Location of meeting area: Adjacent to Contractors’ or Engineers’ office.

1.05 STORAGE AREAS AND SHEDS

A. General: Provide storage areas for the following:
1. Products and materials to be incorporated into new Work;
2. Construction equipment and materials.

B. Location of Storage Areas and Sheds:
1. Site Not Occupied by Owner: The Contractor shall select storage areas within the site.
2. Site Partially Occupied by Owner
   a. If specific areas are designated as storage areas, use the designated storage areas.
   b. If specific areas are not designated as storage areas, the Contractor may use areas within the project site that are not occupied by the Owner and do not interfere with the following:
      (1) Owner’s operations
      (2) Access to Owner occupied facilities
      (3) Work by other Contractors.

C. Additional Storage Areas: Provide additional off-site storage area if available on-site storage area is not adequate for the Contractor, or subcontractors needs.

D. Storage Area Access:
1. Access to storage areas by Owner and Engineer shall meet the requirements of Section 01600 – Material and Equipment.
2. Provide emergency access to stored equipment and materials.
PART 2 - PRODUCTS

2.01 CONDITION

Materials, Equipment, Furnishings: Serviceable, new or used, adequate for required purpose.

2.02 BUILDING REQUIREMENTS

A. Building Type for Field Offices and Sheds: Portable buildings, mobile buildings, or temporary buildings constructed on site.

B. Field Office and Shed Construction:
   1. Field Offices and sheds shall be wood frame, metal frame, or concrete block.
   2. Field Offices and sheds shall be structurally sound, secure, and weather-tight.

C. Ceiling Height for Field Offices and Sheds: 7'-6" minimum.

D. Temperature Transmission Resistance of Floors, Walls, and Ceilings for Field Offices and Sheds: Compatible with occupancy and storage requirements.

E. Exterior Materials for Field Offices and Sheds: Weather resistant, finished.

F. Interior Materials for Field Offices:
   1. Walls and Ceilings: Pre-finished or painted sheet type materials.
   2. Floors: Vinyl tile or resilient sheeting.
   3. Base Molding: Rubber, cove bases, or equal.

G. Interior Materials for Sheds: As required to provide specified conditions for storage of products.

H. Exterior Color for Field Offices and Sheds:
   1. Non-objectionable to Owner and Engineer.
   2. Non-objectionable to public, if visible from outside of project site.

I. Exterior Finish for Field Offices and Sheds:
   1. Free from peeling or excessive fading.
   2. Free of graffiti and other markings not required for identification or safety.

J. Interior Finish for Field Offices:
   1. Clear finished paneling or painted sheet material.
   2. Free from peeling or excessive fading.
   3. Free of graffiti and other markings not required for identification or safety.
K. Interior Wall Finish for Sheds: Finished or unfinished with light color, which does not impair inspection and maintenance of stored products.

L. Door and Frame Material for Field Offices and Sheds: Sound metal, wood, or metal and wood doors and frames.

M. Door Hardware for Field Offices and Sheds:
   1. Doors shall open and close smoothly.
   2. Doors shall have functioning locksets.

N. Window Type for Field Offices: Awning, casement, double hung, or horizontal sliding with operating sash. Windows to have sound wood or metal frames. Window sash shall open and close smoothly and have operating locks. Glass shall be uncracked and unbroken.

O. Glazing Type for Field Office Windows:
   1. Offices and Meeting Rooms: Clear.
   2. Restrooms: Frosted, or clear with blinds.

P. Screens for Field Office Windows: Insect screens securely attached and without holes.

Q. Glazing for Shed Windows: Contractor’s option.

R. Exterior Lighting for Field Offices: One light, 60 watt minimum, at each exterior entrance.

S. Interior Lighting for Field Offices, Including Meeting Area: 50 ft-candles minimum at desk-top height.

T. Exterior Lighting for Sheds: As required for security.

U. Interior lighting for Sheds: As required to permit inspection and maintenance of stored products.

2.03 ENVIRONMENTAL CONTROL

A. Heating, Cooling, and Ventilating for Offices and Meeting Area: Automatic equipment to maintain comfort conditions as follows:
   1. Heating: 78 degrees F.
   2. Cooling: 72 degrees F.

B. Heating, Cooling, and Ventilating for Storage Spaces: Heating, cooling, and ventilation as required to provide environment conditions specified in individual Specification Sections or as recommended by product manufacturer.

2.04 FIRE PROTECTION
A. Provide appropriate type fire extinguisher at each office, meeting area, and each storage area.

B. Provide additional fire protection, such as sprinkler systems, as required to protect stored products.

2.05 CONTRACTOR'S FIELD OFFICES

A. Floor Area for Contractor's Field Office:
   1. Office for Contractor's Superintendent: 400 square feet, minimum.
   2. Other Offices for Contractor and Subcontractors: Contractor's option.

B. Minimum Furnishings and Equipment for Contractor's Field Office:

<table>
<thead>
<tr>
<th>Quantity</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>One</td>
<td>Office desk</td>
</tr>
<tr>
<td>One</td>
<td>Office chair</td>
</tr>
<tr>
<td>One</td>
<td>Four-drawer file cabinet</td>
</tr>
<tr>
<td>One</td>
<td>10” outdoor weather thermometer</td>
</tr>
<tr>
<td>Two</td>
<td>Dedicated telephone lines with one high speed (&gt;1 MB/SEC) internet connection</td>
</tr>
</tbody>
</table>

2.06 ENGINEER'S FIELD OFFICE

A. Size of Engineer’s Field Office: 480 square feet, minimum, with 10’ minimum width.

B. Locks and Keys for Engineer’s Field Office: Provide new lock with two keys for each individually keyed exterior door.

C. Windows for Engineer’s Field Office:
   1. Quantity of Windows for Engineer’s Field Office:
      a. End Room: Three per room, minimum.
      b. Side Rooms and Corner Rooms: Two per room, minimum.
   2. Total Window Area for Engineer’s Field Office: 10 percent of floor area, minimum.
   3. Location of Windows for Engineer’s Field Office: Locate to provide views of construction area.

D. Electrical Systems for Engineer’s Field Office
   1. Electrical Distribution Panel for Engineer’s Field Office: One, 100 amp minimum.
2. Wiring and devices to conform to National Electric Code.

3. Outlets for Engineer’s Field Office:
   a. Outlet Type: 110 volt duplex.
   b. Quantity of Outlets: Four in each room, minimum.

E. Telephone Systems for Engineer’s Field Office
   1. Number of Dedicated Telephone Lines for Engineer’s Field Office: Three, minimum.
   2. Telephone Service Requirements for Engineer’s Field Office:
      a. Voice/Data Communication: Two dedicated lines with one high speed (>1 MB/SEC) internet connection.

F. Wash Room for Engineer’s Field Offices: Provide one dedicated washroom in Engineer’s Office with potable water, water closet and lavatory.

G. Water Heater for Engineer’s Field Office: 30 gallon, minimum.

H. Wash Room Accessories for Engineer’s Field Office:
   1. One, paper towel dispenser, or roll paper towel holder.
   2. One roll toilet paper holder.

I. Minimum Furnishings and Equipment for Engineer’s Field Office:

<table>
<thead>
<tr>
<th>Quantity</th>
<th>Description</th>
<th>Manufacturer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Two</td>
<td>Double pedestal desks with three drawers one side and one supply drawer, one file drawer on opposite side, and 30&quot; x 60&quot; top, minimum</td>
<td>Hon Metro Series, stock model 32444, Vanguard LP 860, or equal</td>
</tr>
<tr>
<td>One</td>
<td>Metal or wood drafting table with 36&quot; x 60&quot;, minimum, top one equipment drawer, and one plan drawer</td>
<td>SAFCO, Catalog No. SAF 3952, or equal</td>
</tr>
<tr>
<td>Two</td>
<td>Metal frame, swivel office chairs with arms</td>
<td>Hon W22 Executive Swivel, United Chair Co. S11, or equal</td>
</tr>
<tr>
<td>Two</td>
<td>Metal frame office chairs with arms</td>
<td>Hon Model W42, or equal</td>
</tr>
<tr>
<td>One</td>
<td>Drafting stool with cushion seat and adjustable back rest</td>
<td>United, Model No. GLN 55S27-DS-BN or equal</td>
</tr>
<tr>
<td>Two</td>
<td>Four-drawer file cabinets, legal size, 52&quot; high, with key lock</td>
<td>Hon 310 Series, Steelmaster, or equal</td>
</tr>
<tr>
<td>One</td>
<td>Three-shelf, metal bookcase, 41&quot; high</td>
<td>Hon S42ABC, or equal minimum</td>
</tr>
<tr>
<td>Two</td>
<td>Metal, waste baskets</td>
<td></td>
</tr>
</tbody>
</table>
Two Floating-arm florescent lamps with clamp base
One Desk lamp with two 15 watt tubes
Two Touch-tone two-line phones
One Facsimile machine, plain paper
One Plain paper copier for 8-1/2 x 11, 8-1/2 x 14, and 11 x 17 paper, with stand
One Electric, bottled water cooler which dispenses cold water and hot water
One Refrigerator, 6 cubic feet, minimum
One Medium industrial First Aid Kit, new, ERB 3200, or equal fully equipped

2.07 MEETING AREA – ENGINEER’S FIELD OFFICE

A. Meeting Area Size:
   1. Minimum Floor Area for Meeting Area: 200 square feet.
   2. Minimum Width Dimension for Meeting Area: 10 feet.

B. Minimum Furnishings and Equipment for Meeting Area:

<table>
<thead>
<tr>
<th>Quantity</th>
<th>Description</th>
<th>Manufacturer</th>
</tr>
</thead>
<tbody>
<tr>
<td>One</td>
<td>Metal or wood, Conference Room table, 12’ x 4’ top, minimum</td>
<td></td>
</tr>
<tr>
<td>Eight</td>
<td>Metal frame office chairs with arms</td>
<td>Hon Model W42, or equal</td>
</tr>
<tr>
<td>One</td>
<td>Dry erase &quot;white board&quot;, 4’ x 6’, wall mount type, with aluminum frame,</td>
<td>Quartet, Catalog No. QRT 7537, or equal and Pentel, Catalog No.PEN MW6-4E, or</td>
</tr>
<tr>
<td></td>
<td>full length marker rail, two erasers, and two boxes of four color dry erase</td>
<td>equal</td>
</tr>
<tr>
<td></td>
<td>markers</td>
<td></td>
</tr>
<tr>
<td>One</td>
<td>Touch-tone phone with speaker</td>
<td></td>
</tr>
</tbody>
</table>

PART 3 - EXECUTION

3.01 PREPARATION

Fill and grade sites for temporary structures to provide drainage away from buildings.

3.02 INSTALLATION

A. Meet local building requirements

B. Block and level portable buildings and mobile buildings
C. Temporary Buildings constructed on site shall be securely fixed to building foundations.

3.03 MAINTENANCE AND CLEANING

A. General:
   1. Maintain and clean offices and sheds as specified in this Section.
   2. Maintain and clean storage areas as specified in Section 01570 – Temporary Controls.

B. Maintain parking area and approach walks free of mud and water.

C. Damaged Offices and Sheds: Repair damaged offices and sheds.

D. Non-functioning Equipment: Repair, or replace, office equipment that is not functioning or not functioning properly.

E. Supplies:
   1. Provide office and janitorial supplies and service required for the functioning of field offices and field office equipment.
   2. Provide the following supplies and service for the Engineer's Office:
      a. Light bulbs and tubes;
      b. Toilet paper;
      c. Towels for the Wash Room;
      d. Soap for the Wash Room;
      e. Paper cups for the Water Cooler;
      f. Paper and supplies for copier and facsimile machines.

F. Cleaning Exterior of Engineer's Field Office, Contractor's and Subcontractors' Field Offices, and Sheds: As required to keep field offices and sheds presentable and free of graffiti and other markings not required for identification or safety.

G. Janitorial Services for Engineer's Field Office and meeting area:
   1. Routine: Twice weekly.
   2. Windows: Monthly or as necessary
   3. Additional: As required to keep office clean when job site or weather conditions produce excessive mud.

3.04 REMOVAL

A. Offices, sheds, and equipment shall remain property of the Contractor, unless otherwise specified.
B. Following completion, testing, and acceptance of new and renovated facilities, remove offices and sheds, including blocking, foundations, utility services, and debris.

C. Restore areas where offices, storage areas and sheds were located, or finish areas as shown on the Drawings, if characteristics of area are to be changed as part of the Work.

END OF SECTION
SECTION 01540
SECURITY

PART 1 - GENERAL

1.01 SECTION INCLUDES
Requirements for project site security

1.02 SITE SECURITY

A. Site Not Occupied by Owner: The Contractor shall be fully responsible for site security until site is partially or fully occupied by Owner.

B. Facilities Partially Occupied by Owner: Site security of partially occupied sites shall be joint responsibility of Contractor and Owner.

1. Contractor shall provide security for the following:
   a. Contractor's and subcontractors' staging areas and storage areas.
   b. Field offices and sheds.
   c. New facilities under construction.
   d. Existing facilities being renovated.

2. Owner shall provide security for the following:
   a. Facilities occupied by Owner.
   b. Site areas solely occupied by Owner.

3. Site Entrance
   a. Contractor shall provide security for site entrance for Contractor's and subcontractors' use.

C. All field workers associated with execution of the Contract Work must obtain security badges from the Facilities Department of Collier County.

1. Each worker must go to the Facilities Department at the Government Center on Tamiami Trail East for fingerprinting, photographing and completion of security application. Workers that fail the security clearance requirements shall not be allowed on the project.

2. The Contractor shall be responsible for payment to the County of the fee associated with each security badge.

3. The Contractor is responsible for renewal of the security badges and for maintaining a current badge for each worker.
4. The Contractor shall retrieve the security badge from each worker no longer employed at the site and turn badge over to the County.

D. The Contractor shall be fully responsible for security of construction equipment, products, small tools, and other items related to the construction.

1.03 SECURITY PROGRAM

A. Protect Work from theft, vandalism, and unauthorized entry.

B. Maintain program throughout construction period until Owner acceptance precludes the need for Contractor security.

1.04 ENTRY CONTROL

A. Restrict entrance of persons and vehicles into construction site.

B. Owner will control entrance of persons and vehicles related to Owner's operations.

PART 2 - PRODUCTS (not used)

PART 3 - EXECUTION (not used)

END OF SECTION
SECTION 01541
FIELD ENGINEERING

PART 1 - GENERAL

1.01 SECTION INCLUDES

Surveying services required for proper layout of work and record information.

1.02 QUALITY CONTROL

A Land Surveyor: Registered in the State of Florida and acceptable to Engineer shall be used for layout of all process piping, layout of building footprints and all Record Drawing information. Refer to Section 01781 – Project Record Documents.

1.03 SUBMITTALS

A. Submit name, address, and telephone number of Registered Land Surveyor to the Engineer before starting work.

B. On request, submit documentation verifying accuracy of survey work for project boundary and vertical and horizontal control.

C. Submit certificate signed by Surveyor with Project Record Documents certifying that elevations and locations of improvements are in conformance, or non-conformance, with Contract Documents.

1.04 PROJECT RECORD DOCUMENTS

A. Maintain complete, accurate log of control and survey work as it progresses.

B. Maintain one set of plans that all record drawing information is kept on. These plans shall show the record information within one week of installation of work or information being made available. Record Drawings will be available for review by the Engineer at any time during the normal work day.

C. Submit Record Documents as specified in Section 01770 - Contract Closeout and Section 01781 – Project Record Documents and in the Collier County Utilities Standards Manual, current version with updates.

PART 2 - PRODUCTS (not used)

PART 3 - EXECUTION

3.01 INSPECTION
3.01 SURVEY REQUIREMENTS

A. Verify locations of survey control points prior to starting work.

B. Promptly notify Engineer of any discrepancies discovered.

3.02 SURVEY REFERENCE POINTS

A. Protect survey control points prior to starting site work; preserve permanent reference points during construction. Make no changes without prior written notice to Engineer.

B. Promptly report to Engineer the loss or destruction of any reference point or relocation required because of changes in grades or other reasons. Replace dislocated survey control points based on original survey control.

3.03 SURVEY REQUIREMENTS

A. Engineer shall provide one bench mark for vertical control and horizontal control during construction. Contractor shall be responsible for laying out the work, shall protect and preserve the established bench mark and shall make no changes or relocations without prior approval of Owner. Contractor shall report to Engineer whenever any reference point is lost or destroyed or requires relocation because of necessary changes in grades or locations, and shall be responsible for the accurate replacement or relocation of such reference points by professionally qualified personnel.

B. Contractor shall establish line and levels, locate and lay out by instrumentation and similar appropriate means:

1. Site improvements, including pavements, stakes for grading, fill and topsoil placement, utility locations, slopes, and invert, or centerline, elevations. Submit cut sheets for gravity sewers to Engineer three days prior to construction.

2. Grid or axis for structures.

3. Building foundation, column locations, and ground floor elevations.

4. Piping locations, slopes, and invert, or centerline, elevations.

C. Periodically verify layouts by same means.

D. Contractor shall provide horizontal and vertical record locations of improvements as specified in Section 001781 – Project Record Documents and shall include the following:

1. Corner coordinates of rectangular or square buildings, structures, and tanks.

2. Center coordinates of circular buildings, structures, and tanks.

4. Floor elevations of structures and tanks as required to define floor slope.
5. Top elevations of structures and tanks.
6. Channel floor elevations at each change in slope.
7. Channel top elevations.
8. Manhole center coordinates for sanitary sewers, storm sewers, and electrical duct banks.
9. Pipe coordinates at changes in direction.
10. Coordinates of buried valves, tees and fittings.
11. All underground piping invert or centerline elevations including at changes in slope.
12. All underground pipe invert or centerline elevations at tees and crosses.
13. Pipe invert, or centerline, elevations at crossing with other pipe.
14. Invert, or centerline, elevations and coordinates of existing pipe at crossing with underground pipe installed under this project.
15. Invert elevations of manhole pipe inlets and outlets.
16. Duct bank coordinates at changes in direction.
17. Top and bottom elevations of duct banks at manholes and handholes.
18. Other horizontal and vertical record data pertinent to completed Work.

E. Ground surface record/information shall include the following:

1. Spot elevations should be shown at a minimum 100-foot rectangular grid, sufficient to show all the important topographic features.
2. Drainage swales.
3. All elevations shown on the construction drawings shall be confirmed or amended on the Project Record Drawings if finished elevations are different.

END OF SECTION
SECTION 01550

ACCESS ROADS AND PARKING AREAS

PART 1 - GENERAL

1.01 SECTION INCLUDES

Requirements for project access roads, haul routes, and parking areas.

1.02 CONSTRUCTION ACCESS AND HAUL ROUTES

A. The Contractor shall make its own investigation of the condition of available public and private roads and of clearances, restrictions, bridge load limits, and other limitations affecting transportation and ingress and egress to the site of the Work. It shall be the Contractor's responsibility to construct and maintain any haul roads required for its construction operations.

B. Traffic Control: For the protection of traffic in public or private streets and ways, the Contractor shall provide, place, and maintain all necessary barricades, traffic cones, warning signs, lights, and other safety devices in accordance with the requirements of the Florida and County Departments of Transportation. The Contractor shall take all necessary precautions for the protection of the Work and the safety of the public. All barricades and obstructions shall be illuminated at night, and all lights shall be kept burning from sunset until sunrise. The Contractor shall station police officers, guards and flaggers and shall conform to such special safety regulations relating to traffic control as may be required by the public authorities within their respective jurisdictions. All signs, signals and barricades shall conform to the requirements of Subpart G, Part 1926, of the OSHA Safety and Health Standards for Construction.

1.03 ON-SITE ACCESS ROADS

A. Provide access roads for the following:
   1. Construction operations.
   2. Material and equipment delivery for construction.
   3. Owner's access to facilities in service.
   4. Owner's access to Owner's offices, shops, and storage areas.
   5. Material and equipment delivery for Owner's operations and maintenance.
   6. Emergency access.

B. Construct temporary access roads as required on route, or routes, approved by Engineer.

C. Provide 20-foot driveway width along approved access route.
D. Access drives shall have load bearing capacity to provide unimpeded traffic for construction operations, Owner access for operation and maintenance of facilities in service, and emergency vehicles.

E. Construct temporary bridges and culverts to span low areas and allow unimpeded drainage.

F. Extend and relocate access drives as Work progress requires.

G. Provide detours as necessary for unimpeded traffic flow.

H. Provide turning space between and around combustible materials.

I. Provide and maintain access to the following:
   1. Fire hydrants.
   2. Facilities in service.
   3. Valves, switches, and controls for facilities in service.

1.04 PARKING

A. Provide temporary parking facilities for use by construction supervisory personnel, Owner's representative, and Engineer.

   1. Provide parking on job site in areas designated and approved by Owner.
   2. Provide additional off-site parking for construction personnel. Provide transportation to and from site from off-site parking.

B. Do not use temporary parking areas for storage of material or equipment to be incorporated in the Work, construction material, or construction equipment.

1.05 PERMANENT PAVEMENTS AND PARKING FACILITIES

A. Prior to Substantial Completion, base for permanent roads and parking areas may be used for construction traffic.

B. Do not allow traffic loading beyond paving design capacity.

C. Do not allow tracked vehicles on surface or base for permanent roads.

1.06 CONSTRUCTION PARKING CONTROL

A. Control vehicular parking to prevent interference with the following:
   1. Public traffic and parking.
   3. Owner's operations.

B. Monitor parking of construction personnel's vehicles.
C. Prevent parking on or adjacent to access roads or in non-designated areas.
D. Do not operate tracked vehicles beyond the limits of the construction site

PART 2 - PRODUCTS

2.01 MATERIALS

A. Temporary Surface: Granular surface may be used unless asphaltic concrete surface is required for dust control.
B. Temporary Surface Over Permanent Base: Equal to permanent surface.
C. Permanent Construction: As shown on the Drawings.

PART 3 - EXECUTION

3.01 PREPARATION

A. Clear areas to be used for temporary access roads and parking.
B. Provide drainage facilities, including retention areas and sediment control, for temporary access roads and parking.

3.02 MAINTENANCE OF CONSTRUCTION ACCESS AND HAUL ROUTES

A. Clean haul vehicles prior to leaving job site if required to prevent dirt from being deposited on either access routes or haul routes.
B. Immediately remove dirt, debris, or dirt and debris deposited or spilled on access routes, haul routes, or access and haul routes.
C. Repair or replace pavement damaged by construction operations or movement of construction equipment or material.

3.03 MAINTENANCE OF ON-SITE ACCESS ROADS AND PARKING AREAS

A. Maintain traffic routes so that emergency vehicles can access the project site, operating facilities, and Owner occupied facilities at all times.
B. Maintain traffic routes and parking areas so that traffic routes and parking areas can be used for their intended purpose by passenger cars.

3.04 REMOVAL AND RESTORATION

A. Remove temporary access drives and parking that are not part of permanent Work.
B. Replace removed surface, base, and subgrade as appropriate to completed Work.

END OF SECTION
SECTION 01570
TEMPORARY ENVIRONMENTAL CONTROLS

PART 1 - GENERAL

1.01 SECTION INCLUDES

Requirements for temporary environmental controls of water, dust, noise, erosion, pollution and pests.

1.02 WATER CONTROL

A. Dewatering Excavations – Shall conform to Section 02240 - Dewatering

B. Surface Water Control
   1. Protect site from puddling or running water.
   2. Grade construction areas so that storm water drains to storm water system or to dewatering systems.

C. Disposal of Discharge Water
   1. Do not contaminate or disturb the environment of properties adjacent to the Work.
   2. Do not contaminate streams or other surface waters.
   3. Do not use sanitary sewers for disposal of water from water control systems.

1.03 DUST CONTROL

A. Provide continuous dust control systems, construction methods, or both which control dust generation and dispersement.

B. Control dust from construction operations, construction traffic, and other traffic on the job site so that:
   1. Visibility is not reduced below safe limits for construction operations and traffic.
   2. Adjacent property does not receive dust from the project site.
   3. Persons, animals, or persons and animals are not injured by dust from the project site.
   4. Dust from the project does not cause a nuisance to the Owner or persons in the vicinity of the project site.
1.04 EROSION AND SEDIMENT CONTROL

   Shall conform to Section 02310 - Erosion and Sediment Control

1.05 NOISE CONTROL

   A. Provide systems, measures, or both so that noise from construction operations, equipment and traffic does not exceed levels permitted by local ordinances.

   B. Control noise from construction operations, equipment and traffic so that:

      1. Noise does not impede the performance of Owner's personnel at the project site.

      2. Persons, animals, or persons and animals are not injured by noise from the project site.

      3. Noise from the project does not cause a nuisance to the Owner or persons in the vicinity of the project site.

   C. Provide hearing protection within the project site for Contractor's personnel, Owner's personnel, and Engineer wherever noise levels exceed occupational exposure limits.

1.06 PEST CONTROL

   A. Provide insect and rodent control for construction areas, staging area, storage area, field offices, and sheds.

   B. Keep storage areas clean and neat.

   C. Provide routine cutting of grass and weeds.

   D. Instruct construction personnel on the prevention of bites from poisonous snakes and spiders when picking up materials and performing other tasks.

1.07 POLLUTION CONTROL

   Provide methods, means, and facilities to prevent contamination of soil, water, and atmosphere from discharge of noxious substances, toxic substances, and pollutants produced by construction operations.

1.09 ACCESS AND HAUL ROUTE

   Contractor shall maintain public access roadways, right-of-way, and haul route free from mud, debris, trash and dust created by the Contractor's activities. Contractor shall provide all services necessary to accomplish this Contract requirement, including continuous crews and equipment, if necessary.

**PART 2 - PRODUCTS**
2.01 CHEMICALS

Chemicals used during project construction or furnished for project operation, whether herbicide, pesticide, disinfectant, polymer, reactant or of other classification, must show approval of either EPA or USDA.

PART 3 - EXECUTION

3.01 USE OF CHEMICALS

Use of chemicals and disposal of residues shall be in strict conformance with manufacturer’s instructions, government regulations, or both, as applicable.

END OF SECTION
PART 1 - GENERAL

1.01 SECTION INCLUDES

General requirements for materials and equipment and requirements for procurement, handling, and storage of materials and equipment.

1.02 GENERAL

A. Furnish and Install

1. Where the words “furnish”, “provide”, “supply”, “replace”, or “install” are used, whether singularly or in combination, they shall mean to furnish and install, unless specifically stated otherwise.

2. In the interest of brevity, the explicit direction “to furnish and install” has sometimes been omitted in specifying materials and/or equipment herein. Unless specifically noted otherwise, it shall be understood that all equipment and/or materials specified or shown on the Drawings shall be furnished and installed under the Contract as designated on the Drawings.

B. Concrete Foundations for Equipment

1. Each Contractor shall provide all concrete foundations shown, specified or required for all equipment furnished under their respective Contract.

2. Anchor bolts and templates for equipment foundations shall be furnished under the respective Contracts for installation by the respective Contractor. The General Contractor shall cooperate with the respective Contractors to secure a satisfactory installation and to maintain the schedule of construction.

3. All concrete foundations for equipment shall be treated, by the respective Contractor, with an approved sealer to prevent oil from seeping into the concrete.

1.03 REFERENCES

A. General: Section 11600, Equipment General, and as specified in Section 01420 - Reference Standards.

B. ANSI Standards

   ANSI B46.1 Surface Texture

C. ASTM Standards
1. ASTM A48 Specification for Gray Iron Castings
2. ASTM A108 Specification for Steel Bars, Carbon, Cold-Finished Standard Quality

1.04 SUBMITTALS
A. General: As specified in Section 01330 - Submittals
B. Lubricant Test Report: as specified in this Section.
C. Substitutions: as specified in this Section.
D. Manufacturer Certificate of Completion: The Contractor shall obtain written certification from the equipment manufacturer, stating that the equipment will efficiently and thoroughly perform the required functions in accordance with the Specifications and as indicated on the Drawings. Contractor shall have responsibility for coordination of all equipment, including motors, variable speed drives, controls, and services required for proper installation and operation of the completely assembled and installed equipment. The Contractor shall submit all such certificates to the Engineer with the shop drawings.

1.05 INFORMATION REGARDING BUY AMERICAN PROVISION
A. The Buy American Provision of Public Law 95-217 (Section 215 of Public Law 92-500 as amended) as implemented by EPA regulations and guidance, generally requires that preference be given to the use of domestic construction material in the performance of this Contract.
B. Products manufactured outside of the United States will not be considered acceptable for the Work unless the Manufacturer and the manufacturing facility (ies) are certified as ISO/9001 compliant.

1.06 QUALITY ASSURANCE
A. Inspection, Field Adjustment, and Startup: Demonstrate that all equipment meets the specified performance requirement.
B. Tolerances: Tolerances and clearances shall be shown on the shop drawings. Adhere to approved tolerances and clearances. Machine work shall be of high-grade workmanship and finish, with due consideration to the special nature or function of the parts. Members without milled ends and which are to be framed to other steel parts of the structure may have a variation in the detailed length of not greater than 1/16 of an inch for members 30 feet or less in length, and not greater than 1/8 of an inch for members over 30 feet in length.
C. Machine Finish: The type of finish shall be the most suitable for the application and shall be shown in micro-inches in accordance with ANSI B46.1. The following finishes shall be used:
   1. Surface roughness not greater than 63 micro-inches shall be required for all surfaces in sliding contact.
2. Surface roughness not greater than 250 micro-inches shall be required for surfaces in contact where a tight joint is not required.

3. Rough finish not greater than 500 micro-inches shall be required for other machined surfaces.

4. Contact surfaces of shafts and stems that pass through stuffing boxes and contact surfaces of bearings shall be finished to not greater than 32 micro-inches.

D. Manufacturer’s Experience: Unless otherwise directed by the Engineer, all equipment furnished shall have a record of at least 5 years of successful, trouble-free operation in similar applications, from the same manufacturer.

PART 2 - PRODUCTS

2.01 GENERAL

A. Products include material, equipment, and systems.

B. Comply with Specifications and referenced standards as minimum requirements.

C. All products shall be new and of the very best quality.

D. Components that are supplied in quantity within a Specification section shall be the same, and shall be interchangeable.

E. All parts of the equipment furnished shall be amply designed and constructed for the maximum stresses occurring during fabrication, erection and continuous operation.

2.02 PRODUCT OPTIONS

A. Products specified by reference standards or by descriptions only: Any product meeting these requirements can be submitted for approval.

B. Products specified by naming one or more manufacturers with a provision for substitutions: Submit a request for substitution for any manufacturer not specifically named.

C. Products specified by naming one or more manufacturers with no provision for substitutions: No substitutions will be allowed.

2.03 SUBSTITUTIONS

A. A request for substitution should be made enough time in advance of procurement to allow time for review by the Engineer. A substitution may not be accepted if it delays the project schedule.

B. Document each request for substitution with complete data substantiating compliance of proposed substitution with material or product specifications.
C. 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 that may be required for Work to be complete in all respects.

4. Waives claims for additional costs that may subsequently become apparent.

D. Substitutions will not be considered when they are indicated or implied on shop drawing or product data submittals without separate written request, or when acceptance will require substantial revision of Contract Documents.

E. Engineer will determine acceptability of proposed substitution, and will notify Contractor of acceptance or rejection in writing within a reasonable time.

2.04 MANUFACTURERS’ CERTIFICATIONS

A. Prior to delivery at project site, furnish an Affidavit of Compliance certified by the equipment manufacturer that the equipment and appurtenances furnished comply with all applicable provisions of applicable referenced standards and these Specifications.

B. Do not deliver equipment to job site until Affidavit of Compliance has been submitted and accepted by the Engineer.

2.05 NOISE AND VIBRATION

A. When in operation, no single piece of equipment shall exceed the OSHA noise level requirements for a one-hour exposure.

B. Equipment that transmits vibration to structures, piping, conduit, or other items connected to the equipment, shall be provided with restrained spring-type vibration isolators or pads per manufacturer’s written recommendations.

C. Equipment that can be damaged by vibration generated by the equipment or by vibration transmitted through piping or other connecting items, shall be provided with vibration damping per manufacturer’s written recommendations.

2.06 WELDING OF EQUIPMENT AND PIPE

A. Shop Welding: Unless otherwise specified or shown, shop welding shall conform to the following:

1. Applicable Standards of the American Welding Society and AWWA for the material and type of item being welded.
2. All composite fabricated steel assemblies, which are to be erected or installed inside a hydraulic structure, including any fixed or movable structural components of mechanical equipment, shall have continuous seal welds to prevent entrance of air or moisture.

3. All welding shall be by the metal-arc method or gas-shielded arc method as described in the American Welding Society's "Welding Handbook" as supplemented by other pertinent standards of the AWS. Qualification of welders shall be in accordance with the AWS Standards governing same.

4. In assembly and during welding, the component parts shall be adequately clamped, supported, and restrained to minimize distortion and for control of dimensions. Weld reinforcement shall be as specified by the AWS code. Upon completion of welding, all weld splatter, flux, slag, and burrs left by attachments shall be removed. Welds shall be repaired to produce a workmanlike appearance, with uniform weld contours and dimensions. All sharp corners of material which is to be painted or coated shall be ground to a minimum of 1/32-inch on the flat.

B. Field Welding: Field welding shall be as specified in individual specification sections. Qualification of welders shall be in accordance with the AWS standards. Prior to commencement of any field welding, the Contractor shall furnish the Engineer a copy of each welder's current certification for the alloy, position and type of welding to be performed.

2.07 PROTECTIVE COATINGS FOR EQUIPMENT

A. Equipment shall be painted or coated in accordance with Division 9 unless otherwise approved by the Engineer. Coated surfaces shall be protected from abrasion or other damage during handling, testing, storing, assembly, and shipping.

B. Gears, bearing surfaces, and other similar surfaces obviously not to be painted shall be given a heavy shop coat of grease or other suitable rust-resistant coating. This coating shall be maintained as necessary to prevent corrosion during periods of storage and erection and shall be satisfactory to the Engineer up to the time of the final acceptance.

C. Shop-painted items which suffered damage to the shop coating shall be touched up as specified in Division 9.

2.08 GEARS AND GEAR DRIVES

A. Unless otherwise specified, gears shall be of the helical or spiral-bevel type, designed and manufactured in accordance with AGMA Standards, with a minimum B-10 bearing life of 60,000 hours and a minimum efficiency of 94 percent. Gear reducer service factor shall be based on nominal motor horsepower and shall be:

1. 2.0 for drives incorporating flexible connections between the driven shaft and the gear reducer.
2. 2.5 for coupled drives with pinion gears incorporating a torsionally soft coupling between the motor and pinion shaft.

3. 2.75 for integral gearmotors with pinion gears where the pinion is rigidly affixed to the motor shaft.

B. For integral gearmotors with pinion gears, pinions shall not be of the shell type. The pinion gear shall be easily removable from the motor shaft in the field.

C. Gear speed reducers or increasers shall be of the enclosed type, oil- or grease-lubricated and fully sealed, with a breather to allow air to escape but keep dust and dirt out. Casings shall be of cast iron or heavy-duty steel construction with lifting lugs and an inspection cover for each gear train.

D. Each oil lubricated gear speed reducer or increaser shall be provided with an oil level sight glass and an oil flow indicator, arranged for easy reading. Oil level and drain location relative to the mounting arrangement shall be easily accessible. Provide oil coolers, or heat exchangers, with required appurtenances when necessary to maintain the proper oil temperature for the application.

E. Input and output shafts shall be designed for the service and load requirements of the equipment of which gear drives are a part. Gears shall be computer-matched for minimum tolerance variation. Each output shaft shall have seals that prevent lubricant leakage. Each oil lubricated gear drive output shaft shall have two positive seals.

F. Where gear drive input or output shafts connect to couplings or sprockets not supplied by the gear drive manufacturer, the gear drive manufacturer shall supply matching key taped to the shaft for shipment.

G. Ship gears and gear drives fully assembled for field installation.

2.09 DRIVE CHAINS

A. General

1. Power drive chains shall be commercial type roller chains and meet ANSI Standards.

2. Provide chain take-up or tightener that provides easy adjustment of chain tension.

3. Provide a minimum of one connecting or coupler link with each length of roller chain.

4. Chain and attachments shall be of the manufacturer’s best standard material and suitable for the process fluid.

B. Sprockets
1. Sprockets shall be used in conjunction with all chain drives and chain-type material handling equipment.

2. Unless otherwise specified, sprockets material shall be as follows:
   a. Sprockets with 25 teeth or less, normally used as a driver, shall be made of medium carbon steel in the 0.40 to 0.45 percent carbon range.
   b. Type A and B sprockets with 26 teeth or more, normally used as driven sprockets, shall be made of minimum 0.20 percent carbon steel.
   c. Large diameter sprockets with Type C hub shall be made of cast iron conforming to ASTM A 48, Class 30.

3. Sprockets shall be accurately machined to ANSI Standards. Sprockets shall have deep hardness penetration in tooth sections.

4. Finish bored sprockets shall be furnished complete with key seat and setscrews.

5. Sprockets shall be of the split type or shall be furnished with taper-lock bushings as required.

6. Idler sprockets shall be furnished with brass or Babbitt bushings, complete with oil hole and axial or circumferential grooving. Steel collars with setscrews may be provided in both sides of the hub.

2.10 V-BELT DRIVES
   A. V-belts and sheaves shall be highest industrial grade and shall conform to ANSI and MPTA Standards.
   B. Unless otherwise specified, sheaves shall be machined from gray cast iron.
   C. Sheaves shall be statically balanced. In some applications where vibration is a potential problem, sheaves shall be dynamically balanced. Sheaves operating at belt speeds exceeding 6,500 feet per minute may be required to be of special materials and construction.
   D. Sheaves shall be furnished complete with taper-lock or QD bushings.
   E. Finish bored sheaves shall be furnished complete with key seat and setscrews.
   F. Sliding motor bases shall be provided to adjust the tension of V-belts.

2.11 DRIVE GUARDS
   A. Power transmission, prime movers, machines, and moving machine parts shall be guarded to conform to the OSHA Safety and Health Standards (29CFR1910).
   B. Where required for lubrication or maintenance, guards shall have hinged access doors.
C. All drive guards and fasteners shall be constructed of stainless steel.

2.12 BEARINGS

A. Bearings shall conform to the standards of the Anti-Friction Bearing Manufacturers Association, Inc. (AFBMA).

B. Fitting practice, mounting, lubrication, sealing, static rating, housing strength, and other factors shall be considered in bearing selection.

C. Grease-lubricated type bearings shall be equipped with a hydraulic grease fitting in an accessible location and shall have sufficient grease capacity in the bearing chamber.

D. Install stainless steel tubing and supports as necessary to extend grease fittings so that greasing can be done from platforms and walkways used by the Owner in routine operations.

E. Permanently lubricated bearings shall be factory-lubricated with the manufacturer's recommended lubricant.

F. Except where otherwise specified or shown, bearings shall have a minimum B-10 life expectancy of 60,000 hours.

G. Bearing housings shall be of cast iron or steel and bearing mounting arrangement shall be as specified or shown, or as recommended in the published standards of the manufacturer. Split-type housings may be used to facilitate installation, inspection, and disassembly.

H. Sleeve-type bearings shall have a Babbitt or bronze liner.

2.13 SHAFTING

A. Shafting shall be continuous between bearings and shall be sized to transmit the power required. Keyways shall be accurately cut in line. Shafting shall not be turned down at the ends to accommodate bearings or sprockets whose bore is less than the diameter of the shaft. Shafts shall rotate in the end bearings and shall be turned and polished, straight, and true.

B. Shafting materials shall be appropriate for the type of service and torque transmitted. Environmental elements such as corrosive gases, moisture, and fluids shall be taken into consideration. Materials shall be as shown or specified unless furnished as part of an equipment assembly.

1. Low carbon cold-rolled steel shafting shall conform to ASTM A108, Grade 1018.

2. Medium carbon cold-rolled shafting shall conform to ASTM A108, Grade 1045.

3. Corrosion-resistant shafting shall be stainless steel or monel, whichever is most suitable for the intended service.
C. Where differential settlement between the driver and the driven equipment may be expected, a shaft of sufficient length with two sets of universal type couplings shall be provided.

D. All shafting shall be dynamically balanced in accordance with the recommendations of the shafting manufacturer.

E. The Contractor shall furnish and install a heavy-duty shaft guard for all drive shafting which is less than seven feet above floor or platform level in accordance with the provisions of Paragraph 1910.210 of OSHA Rules and regulations. Provision shall be made in the guard as necessary for lubrication and inspection access of the joints and bearings without the necessity of removing the entire guard assembly.

2.14 COUPLINGS

A. Flexible couplings shall be provided between the drivers and driven equipment. Flexible couplings shall accommodate angular misalignment, parallel misalignment, end float. Flexible couplings shall cushion shock loads.

B. Equipment manufacturer shall select or recommend the size and type of coupling required to suit each specific application.

C. Where required for vertical shafts, 3-piece spacer couplings shall be installed.

D. Taperlock bushings may be used to provide for easy installation and removal on shafts of various diameters.

E. Where universal type couplings are shown, they shall be of the needle bearing type construction, equipped with commercial type grease fittings.

2.15 EQUIPMENT FOUNDATIONS

A. Provide equipment foundations in accordance with equipment manufacturers' written instructions.

B. Mount mechanical equipment, tanks, and floor mounted control cabinets on minimum 4" high concrete bases, as shown on standard details, unless otherwise shown or specified.

C. Submit foundation drawings for review.

2.16 SHOP FABRICATION

Perform shop fabrication in accordance with the final reviewed and processed shop drawings.

2.17 NAMEPLATES

A. Equipment nameplates shall be stainless steel. Nameplates shall be engraved or stamped. Fasten nameplates to equipment in an accessible location with No. 4 or larger oval head stainless steel screws or drive pins.
B. Nameplates shall contain the manufacturer’s name, model, serial number, size, characteristics, and appropriate data describing the machine performance ratings.

2.18 WARRANTIES

Furnish warranties as specified in Section 01780 – Warranties and Bonds

2.19 SPARE PARTS

Following approval of the spare parts list by the Engineer and immediately prior to Substantial Completion, furnish spare parts suitably packaged for long-term storage and labeled with the date of supply, the equipment number and part number, equipment description and part description.

PART 3 - EXECUTION

3.01 DELIVERY, STORAGE, AND HANDLING

A. Contractor shall be responsible for the delivery, storage, and handling of products.

B. Equipment shall be boxed, crated, or otherwise protected from damage and moisture during shipment, handling, and storage. Equipment shall be protected from exposure to corrosive fumes and shall be kept thoroughly dry.

C. Each item of equipment shipped shall have a legible identifying mark corresponding to the equipment number shown or specified for the particular item.

D. Transport products by methods that prevent product damage. Deliver products dry and in undamaged condition in manufacturer's unopened containers or packaging. Promptly inspect shipments to assure that products comply with requirements, quantities are correct, and products are undamaged.

E. Load and unload equipment and appurtenances by hoists or skidding and in accordance with the manufacturer's recommendations. Do not drop products. Do not skid or roll products on or against other products. Pad slings and hooks in a manner that prevents damage to products.

F. Store products in accordance with manufacturer's instructions, with seals and labels intact and legible. Store sensitive products in weather-tight enclosures; maintain within temperature and humidity ranges required by manufacturer's instructions. Store products that will be deteriorated by sunlight in a cool location out of direct sunlight. Rubber products shall not come in contact with petroleum products.

G. For exterior storage of fabricated products, place on sloped supports above ground. Cover products subject to deterioration with impervious sheet covering and as recommended by manufacturer; provide ventilation that avoids condensation.

H. Deliver pipe, fittings, valves, and accessories in a clean and undamaged condition. Store pipe, fittings, valves, and accessories off the ground and in accordance with manufacturer's instructions. Do not stack ductile iron pipe higher than the limits shown in ANSI/AWWA C600. Stacking of pipe shall meet the requirements of the pipe manufacturer. Do not stack fittings, valves, valve boxes, or valve stands.
I. Keep stored products safe from damage or deterioration. Keep the interior of pipe, fittings, valves, and appurtenances free from dirt or foreign matter. Drain and store valves in a manner that will protect valves from damage. Store gaskets, plastic pipe and fittings, and other products that will be deteriorated by sunlight in a cool location out of direct sunlight.

J. Equipment having moving parts such as gears, bearings, and electric motors; instruments; control panels; motor control centers; and switchgear shall be stored in a temperature and humidity controlled area until equipment is installed and permanent HVAC systems are in operation.

K. Stored electric motors and actuators with space heaters shall have the space heaters energized. When electric motors and actuators with space heaters are installed, the space heaters shall be connected and energized. Space heaters shall remain energized until equipment is accepted and placed in service.

L. Arrange storage to provide access for inspection. Periodically inspect to assure products are undamaged, and are maintained under required conditions.

M. Promptly remove damaged products from the job site. Replace damaged products with undamaged products at no expense to Owner.

3.02 MANUFACTURERS' REPRESENTATIVES

A. Provide the services of experienced, competent, and authorized service representative of the manufacturer of the items of equipment when specified in the individual Product Section.

B. Manufacturers' representatives shall visit the site of Work, and shall perform the following tasks:

1. Assist Contractor in installation of equipment.

2. Inspect, check, adjust equipment, and approve equipment installation.

3. Start-up and field-test equipment for proper operation, efficiency, and capacity. Perform necessary field adjustments during the test period until equipment installation and operation are satisfactory to the Engineer.

4. Supervise functional test as specified in Section 01750 – Testing and Start-Up

5. Instruct Owner's personnel in operation and maintenance of equipment as specified in this Section.

C. The times specified in the individual product sections for the Manufacturer's Representative to provide services are exclusive of travel time to and from the facility. The times specified shall not be construed as to relieve the manufacturer of any additional visits to provide sufficient service to place the equipment in satisfactory operation.

3.03 INSTALLATION - GENERAL

A. Install equipment in accordance with acceptable procedures submitted with the shop drawings and as indicated on the Drawings, unless otherwise accepted by the Engineer.
B. Measure drive shafts just prior to assembly to ensure correct alignment without forcing.

C. Support pipe, fittings, valves, conduit, and other items connected to equipment so that there are no excess stresses and loads on equipment.

D. Equipment shall be secure in position and neat in appearance.

3.04 INSTALLATION OF EQUIPMENT

A. Equipment and materials shall be installed in accordance with the requirements of the General Conditions, Supplemental Conditions and the respective Specification Sections.

B. Concrete foundations for equipment shall be of approved design and shall be adequate in size, suitable for the equipment erected thereon, properly reinforced, and tied into floor slabs by means of reinforcing bars or dowels. Foundation bolts of ample size and strength shall be provided and properly positioned by means of suitable templates and secured during placement of concrete. Foundations shall be built and bolts installed in accordance with the manufacturer’s certified drawings.

C. Before mounting equipment on a foundation, the Contractor shall clean the top surface; if necessary, rough it with a star chisel and clean again; and clean out all foundation bolt sleeves. The Contractor shall provide a sufficient number of stainless steel plate shims about 2-inches wide and 4-inches long, and of a varying thickness from 1/8 to 1/2 inch. A combination of these shims shall be placed next to each foundation bolt to bring the bottom of the bedplate or frame about 1/8 inch above the final setting. The equipment shall be lowered by changing the combination of shims. Using stainless steel shim stock of various thicknesses, continue to level the equipment a little at a time and in rotation until it is at the correct elevation in both directions. When the equipment is level, tighten down on the foundation bolts a little at a time in rotation until it is properly level and does not shift on the shims. A preliminary alignment check shall be made before grout is placed.

D. Equipment shall be set, aligned and assembled in conformance with manufacturer’s drawings or instructions. Run out tolerances by dial indicator method of alignment shall be plus or minus .002 inches, unless otherwise directed by the Engineer.

E. All blocking and wedging required for the proper support and leveling of equipment during installation shall be furnished by the Contractor. All temporary supports shall be removed, except stainless steel wedges and shims, which may be left in place with the approval of the Engineer.

F. Each piece of equipment or supporting base, bearing on concrete foundations, shall be bedded in grout. The Contractor shall provide a minimum of 1-1/2 inch thick grouting under the entire baseplate supporting each pump, motor drive unit and other equipment. Grout shall be non-shrink grout, as specified under Section 03315 entitled “Grout”.

G. When motors are shipped separately from driven equipment, the motors shall be received, stored, meggered once a month, and the reports submitted to the Engineer. After driven equipment is set, the motors shall be set, mounted, shimmed, millrighted, coupled and connected complete. Motors shall then be turned once per month and documented by the Contractor to the Owner/Engineer.
3.05 CONNECTIONS TO EQUIPMENT

A. Connections to equipment shall follow manufacturer’s recommendations as to size and arrangement of connections and/or as shown in detail on the Drawings or approved Shop Drawings. Piping connections shall be made to permit ready disconnection of equipment with minimum disturbance of adjoining piping and equipment.

3.06 LUBRICANTS

A. Furnish and install lubricants required for initial operation.

B. Maintain lubricants at proper levels until equipment is accepted.

C. Change lubricants in each piece of equipment following equipment initial run-in. The manufacturer shall test removed lubricants for metal particles and lubricant breakdown. Submit lubricant test report to the Engineer. If the equipment manufacturer requires the first lubricant change prior to Final Completion, the Contractor shall remove lubricant and furnish and install the necessary lubricants.

3.07 FIELD TESTS

A. Field test equipment in accordance with Section 01750 - Testing and Start-up.

B. Field test equipment as specified in individual Specification Sections.

3.08 FUNCTIONAL TEST

Prior to placing systems in service, perform functional test of each system as specified in Section 01750 - Testing and Start-up.

3.09 TRAINING

A. Manufacturer’s representative, responsible subcontractor, or both shall instruct Owner’s designated operating and maintenance personnel in correct operation and maintenance procedures for equipment and systems when specified in individual product specification sections. Qualified persons who have been made familiar in advance with equipment and systems at Owner’s facility shall give on-site instruction.

B. Submit to Engineer not less than 14 days prior to each training session an outline of the training program and the qualifications of the trainer(s).

C. Coordinate training with the Owner. Notify Owner not less than 14 days in advance of each training session.

D. Provide training while equipment is fully operational.

E. Provide training for up to three separate shifts of Owner’s personnel between the hours of 6:00 A.M. and 6:00 P.M. as necessary to accommodate Owner’s personnel schedule. Duration of each training session shall be not less than two hours or more than six hours.

F. Operation and Maintenance Data as specified in Section 01830 shall be submitted and accepted prior to commencement of training. Use accepted Operation and Maintenance manuals as the basis of instruction.
1. Review contents of manual with personnel in full detail.
2. Explain all aspects of operation and maintenance.
3. Demonstrate start-up, operation, control, adjustment, calibration, trouble-shooting, servicing, maintenance, and shutdown of equipment.

END OF SECTION
SECTION 01740
CONSTRUCTION CLEANING

PART 1 - GENERAL

1.01 SECTION INCLUDES

Requirements for cleaning project site and disposal of waste materials, debris, and rubbish during construction.

1.02 SITE AND FACILITIES CLEANING

A. Site Not Occupied by Owner: The Contractor shall be fully responsible for cleaning until site is partially or fully occupied by Owner after attaining Substantial Completion.

B. Facilities Partially Occupied by Owner: Cleaning of partially occupied sites shall be responsibility of the Contractor.

   1. Contractor shall clean the following:
      a. Contractors and subcontractors' staging areas and storage areas.
      b. Field offices and sheds.
      c. New facilities under construction.
      d. Existing facilities being renovated.

   2. Owner shall be responsible for cleaning the following:
      a. Facilities occupied solely by Owner.
      b. Site areas solely occupied by Owner.

PART 2 - PRODUCTS

2.01 EQUIPMENT

Provide covered containers for deposit of waste materials, debris, and rubbish.

PART 3 - EXECUTION

3.01 CLEANING - GENERAL

A. Maintain areas under Contractor's control free of waste materials, debris, and rubbish. Maintain site in a clean and orderly condition.

B. Remove debris and rubbish from pipe chases, plenums, attics, crawl spaces, and other closed or remote spaces, prior to closing the space.
C. Periodically clean interior areas to provide suitable conditions for work.
D. Broom clean interior areas prior to start of surface finishing, and continue cleaning on an as-needed basis.
E. Control cleaning operations so that dust and other particulates will not adhere to wet or newly coated surfaces.

3.02 CLEANING OF NEW WORK
A. The Contractor shall be fully responsible for cleaning related to new Work including, but not necessarily limited to, the following:
   1. Cleaning of cured, or partially cured, concrete surfaces prior to placement of additional concrete.
   2. Cleaning of joint surfaces prior to making joints.
   3. Cleaning of surfaces prior to application of finish.
   4. Cleaning of equipment and enclosures prior to Substantial Completion.
   5. Cleaning of new buildings and renovated buildings prior to Substantial Completion.
B. Cleaning relative to new Work shall be as specified in individual specifications sections.

3.03 DISPOSAL
A. Remove waste materials, debris, and rubbish from site periodically.
B. Remove temporary materials, equipment, services, and construction prior to Substantial Completion inspection.

3.04 REPAIR AND RESTORATION
A. Clean and repair damage caused by installation or use of temporary facilities.
B. Restore existing facilities used during construction to condition prior to construction.

END OF SECTION
PART 1 - GENERAL

1.01 SECTION INCLUDES

Procedures for starting of mechanical, electrical, control systems, and monitoring systems.

1.02 GENERAL

A. Do not place new facilities and modified facilities in service until:
   1. Equipment and controls have been successfully started up and tested;
   2. Draft O&M manuals have been provided;
   3. Training of Owner’s personnel has been satisfactorily completed.

B. In addition to testing and starting up Contractor supplied equipment, the Contractor shall provide coordination labor, construction equipment and tools, and supervision as required to support start-up and testing of the Owner supplied equipment. It is anticipated the start-up and testing of the Owner supplied equipment will require, at a minimum, 300 hours of time, which may occur over a discontinuous period with multiple interruptions. The Contractor shall, at a minimum, provide a journeyman pipe fitter and electrician and instrument technician and equipment operator and three skilled laborers and one supervisor for this 300 hour period of testing and start-up for Owner supplied equipment.

1.03 QUALITY CONTROL

A. When specified in individual Product Specification Sections, require manufacturer to provide authorized representative to be present at site at time of startup, testing, and training

B. Manufacturer’s representative shall perform services as described in Section 01600 - Material and Equipment.

1.04 SUBMITTALS

A. General: as specified in Section 01330 - Submittals.

B. In addition, submit the following to the Engineer:

   1. Preliminary schedule listing times, dates and sequence for start-up of each item of equipment fourteen days prior to proposed dates.
2. Manufacturer's representative reports within ten (10) days after testing.

3. Each manufacturer shall prepare and submit a completed document, which is contained at the end of this Section, certifying the installation is acceptable and meets their standards and the equipment or device is functioning properly. The Contractor shall submit these certifications to the Engineer prior to either Substantial Completion or placing the equipment in service. A sample of the required certification document is appended to this Section 01750.

PART 2 - PRODUCTS (not used)

PART 3 – EXECUTION

3.01 INSPECTION

A. Verify that Project conditions comply with requirements.

B. Verify that status of Work meets requirements for starting of equipment and systems.

3.02 PREPARATION AND CONTRACTOR’S INITIAL START-UP AND INTIAL FUNCTIONAL TEST

A. Coordinate sequence for initial start-up of various items of equipment.

B. Notify Engineer fourteen (14) days prior to initial start-up of each item of equipment.

C. Have Contract Documents, shop drawings, product data, and operation and maintenance data at hand during entire start-up process.

D. Provide control diagrams that show actual control components and wiring.

E. Verify that each piece of equipment has been checked for proper lubrication, drive rotation, belt tension, control sequence, noise, vibration and other conditions that may cause damage.

F. Verify control systems are fully operational in automatic and alternate modes of operation.

G. Verify that tests, meter readings, and specific electrical characteristics agree with those specified by electrical equipment manufacturer.

H. Verify that instruments, meters, and gages have been calibrated. Perform three-point calibration on continuous elements and systems. Provide calibration records.

I. Conduct start-up and initial functional testing.
J. Provide temporary flow meters and other measurement devices as required for testing of equipment and systems.

3.03 START UP AND FUNCTIONAL TEST – DEMONSTRATION FOR OWNER AND ENGINEER

A. Perform satisfactory Contractor’s initial start-up and functional test prior to demonstration for Owner and Engineer.

1. Perform pre-startup inspection of installation.
2. Perform startup under no-load conditions, if possible. Observe noise, vibration and operation.
3. If all operating characteristics are normal, proceed with startup.
4. Operate equipment and system under all lead conditions and confirm all operating characteristics are normal. If normal operation is observed, proceed with witnessed functional test and performance test as required.

B. Perform functional and performance tests.

1. Perform functional and performance tests under supervision of responsible manufacturers’ representatives, instrumentation and control subcontractor, and Contractor personnel.
2. Representatives of Owner and Engineer shall witness functional test.
3. Perform functional and performance tests on each piece of equipment and operational system as specified in the individual product sections.
4. If system is to be placed in service in phases, perform functional and performance tests on each part of system prior to placing each part of system in service.

C. Demonstrate that equipment operates and complies with specified performance requirements.

D. Demonstrate that control panel functions, including failures and alarms, operate and comply with specified performance requirements.

E. Functional test shall be non-destructive.

F. If approved by the Engineer, simulate failures and alarm conditions by jumping failure input terminals.

G. Provide signal generators that simulate control conditions if it is not feasible to create actual conditions.

H. Use actual as-built control diagrams in demonstration of functions.

I. Use Operation and Maintenance manuals to demonstrate operation of equipment.
J. If functional test or performance test does not meet requirements specified in this Section, Contractor shall compensate Engineer for additional time required to observe functional testing until system successfully completes functional testing.

3.04 TRAINING

A. Training shall not occur until after completion of successful functional testing and performance testing.

B. Comply with Section 01600 – Material and Equipment, Parts 3.02 through 3.07.

C. Comply with Section 01830 – Operation and Maintenance Data.

3.05 PLACING SYSTEMS IN SERVICE

A. Complete functional and performance testing prior to placing system in service.

B. Execute start-up under supervision of responsible manufacturer's representative and Contractor personnel.

C. Place equipment in operation in proper sequence.

END OF SECTION
MANUFACTURER’S CERTIFICATE OF
PROPER INSTALLATION AND OPERATION

MEMBRANE WATER TREATMENT PLANT
PORT OF THE ISLANDS

PRODUCT: ________________________________

SERIAL NO.: ________________________________

SPECIFICATION SECTION: ____________________

Date____________________

As an authorized representative of the manufacturer, the undersigned certifies the product identified above has been inspected and is installed in accordance with the manufacturer’s recommended standards, except as noted below.

The undersigned further certifies that the product identified above has been placed into satisfactory operation and that all controls, safety devices and product systems are functional, except as noted below.

Exceptions and comments:

____________________________________________________________________
____________________________________________________________________
____________________________________________________________________
____________________________________________________________________
____________________________________________________________________
____________________________________________________________________

Signature: __________________________________________

Printed Name: _________________________________________

A copy of this executed Certificate must be included in the Operation and Maintenance Data. A copy must be forwarded to the Engineer upon completion of startup and testing.
SECTION 01770

CONTRACT CLOSEOUT

PART 1 - GENERAL

1.01 SECTION INCLUDES

Requirements for contract closeout.

1.02 CLOSEOUT PROCEDURES

A. Comply with procedures stated in General Conditions of the Contract for issuance of Certificate of Substantial Completion.

B. When Contractor considers work has reached final completion, submit written certification that Contract Documents have been reviewed, work has been inspected, and that Work is complete in accordance with Contract Documents and ready for Engineer’s inspection.

C. In addition to submittals required by the conditions of the Contract, provide submittals required by governing authorities, and submit a final statement of accounting giving total adjusted Contract Sum, previous payments, and sum remaining due.

D. If appropriate, Engineer will issue a final Change Order reflecting approved adjustments to Contract Sum not previously made by Change Order.

1.03 PROJECT RECORD DOCUMENTS

A. Project Record Documents shall be as specified in Section 01781 – Project Record Documents.

B. Prior to Contract closeout, submit Record Documents to Engineer with transmittal letter containing date, Project title, Contractor’s name and address, list of documents, and signature of Contractor. Certification of the Record Drawings by a licensed surveyor is required as noted in Section 01541 – Field Engineering

1.04 WARRANTIES AND BONDS

Contractor shall ensure that all warranties and bonds have been received and submitted to Owner as specified in Section 01780 – Warranties and Bonds.

1.05 SPARE PARTS

A. Contractor shall ensure that all spare parts have been provided as specified in individual Product Sections. Spare parts shall be packaged and labeled as specified in Section 01600 – Material and Equipment.
B. Contractor deliver the spare parts to the Owner at one time. The delivery shall include an itemized list to be signed and dated by the receiving party for the NCWRF.

1.06 OPERATION AND MAINTENANCE MANUALS

Contractor shall ensure that Operation and Maintenance manuals have been provided to the Owner as specified in Section 01830 – Operation and Maintenance Data.

1.07 CERTIFICATES OF PROPER INSTALLATION AND OPERATION

Contractor shall provide complete Certificates of Proper Installation and Operation as specified in the Contract documents.

PART 2 - PRODUCTS (not used)

PART 3 – EXECUTION

3.01 FINAL CLEANING

A. Execute prior to final inspection.

B. Clean interior and exterior surfaces exposed to view; remove temporary labels, stains and foreign substances, polish transparent and glossy surfaces, vacuum carpeted and soft surfaces. Clean equipment and fixtures to a sanitary condition. Clean or replace all filters of mechanical ventilation equipment immediately after issuance of Substantial Completion. Clean roofs, gutters, downspouts, and drainage systems.

C. Clean site, sweep paved areas, and rake clean other surfaces.

D. Remove waste, surplus materials, rubbish and temporary construction facilities from the site.

END OF SECTION
SECTION 01780
WARRANTIES AND BONDS

PART 1 - GENERAL

1.01 SECTION INCLUDES

Requirements and procedures for warranties and bonds.

1.02 SUBMITTALS

A. General: As specified in Section 01330 - Submittals

B. Warranties and Bonds

1. Obtain warranties and bonds, executed in duplicate by responsible Subcontractors, suppliers, and manufacturers.

2. The beginning of the warranty period shall be the Date of Substantial Completion.

3. Verify that documents are in proper form, contain full information, and are notarized.

4. Co-execute submittals when required.

5. Retain warranties and bonds until time specified for submittal.

C. Form of Submittals

1. Bind in Operation and Maintenance Manuals as specified in Section 01830 – Operation and Maintenance Data.

2. Provide full information, using separate typed sheets as necessary.

3. List Subcontractor, supplier, and manufacturer, with name, address, and telephone number of responsible principal.

PART 2 - PRODUCTS (not used)

PART 3 - EXECUTION (not used)

END OF SECTION
SECTION 01781
PROJECT RECORD DOCUMENTS

PART 1 – GENERAL

1.01 SECTION INCLUDES
Requirements for preparation, maintenance and submittal of project record documents. The Contractor’s attention is specifically directed to Part 3.02.B of this Section.

1.02 SUBMITTALS
A. General: as specified in Section 1330 - Submittals
B. At Contract close out, deliver one copy of record documents to Engineer as specified in Section 01770 – Contract Closeout.

1.03 REQUIREMENTS
Contractor shall maintain at the site for the Owner one record copy of:
A. Drawings
B. Specifications
C. Addenda
D. Change orders and other modifications to the Contract
E. Engineer’s field orders or written instructions
F. Approved shop drawings, working drawings and samples
G. Field test records
H. Construction photographs
I. Detailed Progress Schedule

PART 2 – PRODUCTS (not used)

PART 3 – EXECUTION

3.01 MAINTENANCE OF DOCUMENTS AND SAMPLES
A. Project record documents shall be stored in Contractor’s field office or other location approved by the OWNER apart from documents used for construction
B. Maintain documents in a clean, dry, legible condition and in good order. Do not use record documents for construction purposes.
C. Make documents and samples available at all times for inspection by the Engineer and/or Owner.

3.02 RECORDING

A. General

1. Label each document “PROJECT RECORD” in neat, large printed letters.
2. Record information concurrently with construction progress. Do not conceal any work until required information is recorded.
3. Record information in red ink.

B. Record Drawings

1. **Record information on Drawings shall be as specified in Section 01541 – Field Engineering.** The Record Drawings require certification of all as-built information, including vertical and horizontal data, for above and below ground improvements including underground piping, fittings, valves, manholes, junction boxes and ductbanks, by a Florida Registered Land Surveyor.

2. Drawings shall indicate all deviations from Contract Drawings including:
   a) Field changes of dimension and detail
   b) Changes made by Change Order
   c) Details, utilities, piping or structures not on original Contract Drawings.
   d) Equipment and piping relocations.

C. Specifications and Addenda

Legibly mark each Section to record:

1. Manufacturer, trade name, catalog number and supplier of each product and item of equipment actually installed.

2. Changes made by Field Order or Change Order.

D. Shop Drawings

1. Keep one copy of the final, approved shop drawing with the Record Documents. Do not keep previously rejected submittals unless they are necessary to complete the submittal.

2. Record documents should include all shop drawing information submitted. Additional information submitted during the Engineer’s review process should be filed with the appropriate submittal.

END OF SECTION
SECTION 01830
OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.01 SECTION INCLUDES

Requirements for content and submittal of manufacturers’ operation and maintenance data and content and submittal of Facility's Operation and Maintenance manual.

1.02 SUBMITTALS: MANUFACTURERS’ O&M DATA

A. Submittals shall be as specified in Section 01330 – Submittals.

B. Draft: Submit three draft copies of manufacturer’s O&M Data not later than shipment of product. Draft O&M Data shall include binding. The Engineer will review and return two copies with comments.

C. Final: Revise the manufacturer’s O&M Data based upon completed installation and any deficiencies noted during instruction and training of Owner’s personnel. Submit six copies of the complete, final O&M Data. Submit final O&M Data not more than 30 days after final inspection and startup.

1.03 CONTENTS, EACH VOLUME OF MANUFACTURER O&M DATA

A. Table of Contents: Provide title of Project; names, addresses, and telephone numbers of Engineer, subconsultants, and Contractor with name of responsible parties; schedule of products and systems, indexed to content of the volume.

B. For Each Product or System: List names, addresses, facsimile and telephone numbers of Subcontractors and suppliers, including local source of supplies and replacement parts.

C. Product Data: Mark each sheet to clearly identify specific products and component parts, and data applicable to installation. Delete inapplicable information.

D. Drawings: Supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams. Do not use Project Record Documents as maintenance drawings.

E. Instructions: As required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer’s instructions.

F. Each manual shall comply with Parts 2.01 .D through .G and 2.02 of this Section.

G. Warranties and Bonds: Bind in copy of each.
H. Additional Requirements: As specified in individual Product specification sections.

1.04 DATA FOR MATERIALS AND FINISHES

A. Building Products, Applied Materials, and Finishes: Include product data, with catalog number, size, composition, and color and texture designations. (Provide information for re-ordering custom manufactured Products.)

B. Instructions for Care and Maintenance: Include manufacturer's recommendations for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.


1.05 DATA FOR EQUIPMENT AND SYSTEMS

A. Each Item of Equipment and Each System: Provide the following:
   1. Product description;
   2. Operating Procedures;
   3. Maintenance Procedures;
   4. Parts;
   5. Lubricants;
   6. Procedures and requirements for short term (<3 months) storage and for long term storage;
   7. Other Specified Data.

B. Manufacturer's Printed Operation and Maintenance Instructions: Provide manufacturer's printed operation and maintenance instructions.

C. Control Data: Provide the following:
   1. Include sequence of operation by controls manufacturer.
   2. Control diagrams by controls manufacturer as installed.

D. Panelboard Circuit Directories: Provide electrical service characteristics, controls and communications.

E. Drawings, Diagrams, and Charts: Provide the following:
   1. Color coded wiring diagrams as installed;
   2. Contractor's coordination drawings, with color-coded piping diagrams as installed.
   3. Charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.
F. Tests and Reports: Include tests and reports as specified in the following Sections:
   1. Section 01430 – Material Testing
   2. Section 01450 – Quality Control
   3. Section 01750 – Testing and Startup
   4. Division 02 through Division 16 – Individual Product specification sections.

1.06 OPERATION AND MAINTENANCE DATA REQUIREMENTS

A. Product Description
1. Identify each system and system component. Use identification numbers presented in the Contract Drawings and Specifications.
2. Describe function, physical characteristics, normal operating characteristics, and alternate operating procedure.
3. Present performance curves, engineering data, and test results.
4. Describe operating limitations, environmental limitations, and any other limitations.

B. Operating Procedures
1. Provide instructions, including required sequences, for the following operations:
   a) Start-up following installation.
   b) Break-in.
   c) Routine
   d) Preventative maintenance.
   e) Calibration.
   f) Emergency shutdown.
   g) Start-up following emergency shutdown.

2. Provide operating procedures for variations in sunlight, temperature, and humidity.

3. Provide operating procedures for variations in demand, flow, and loading.

4. Provide special operating procedures vital to the product.

C. Maintenance Procedures
1. Provide instructions for preventative, routine, and periodic maintenance including the following:
   a) Servicing and lubricating schedule and sequences.
   b) Wearing parts replacement schedule, including part numbers.
c) Product disassembly and assembly.
d) Alignment, adjustment, and testing.
c) Product re-calibration.

2. Provide a "trouble shooting" guide and repair instructions.

D. Parts

1. Provide complete nomenclature for all product parts including manufacturer's part number for replacement parts.
2. Provide a list of recommended spare parts with instructions for storage of recommended spare parts.
3. Provide a list of local sources of supply for parts.

E. Lubricants

1. Provide a list of lubricants required. Identify the parts to be lubricated with each listed lubricant.
2. Submit separate lubrication schedule for each piece of equipment.
3. Other Data: Provide other Operation and Maintenance Data as specified in the individual Product specification sections.

F. Other Data: Provide other operation and maintenance data as specified in the individual product specification sections.

PART 2 – PRODUCTS

2.01 GENERAL DESCRIPTION: FACILITY OPERATION AND MAINTENANCE MANUAL

A. General: The Contractor shall submit a Facility Operation and Maintenance Manual, which shall be a compilation of all manufacturer's O&M data. This data shall include the data provided by the Contractor for the project known as Membrane Water Treatment Plant, Port of the Islands – (Year Completed). The compilation shall be organized in binders by unit process.

B. Binding

1. The Facility Operation and Maintenance (O&M) Manual shall be bound in multiple binders. Binding by suppliers and manufacturers of their O&M data is acceptable if the binding meets the requirements of this Section. Contractor shall provide binding for O&M Manual if the supplier does not provide binding which meets the requirements of this Section.

2. Binding shall be 8-1/2" X 11" size. Binder capacity shall be not less than 2" or more than 3".
3. Binding shall be three-hole, left margin.
4. Binders shall be telescoping post type.
5. Binder covers shall be polyethylene.
6. Each binder shall be identified on the binder front and spine. Multiple volumes with the same identification shall be numbered sequentially using Arabic numerals. Binder data and copy of art work shall be submitted to Engineer for approval.

C. Table of Contents: Provide a detailed Table of Contents in each Binder.

D. Index of Tabs

1. Provide a tabbed index sheet for each equipment item, component, or subject. Index tabs shall provide quick reference points, which assist the Owner’s personnel in the use of the manual.
2. Indexes shall be 90-lb. stock, minimum. Tabs and binding strips shall be reinforced.

E. Text

1. Text shall be legible and written in English. Each letter in the text shall be identifiable. Text shall be technically and grammatically correct.
2. Prepare the text so that operation and maintenance personnel can easily read, understand, and properly apply the instructions contained in the text. Arrange the text in a logical format. Use headings to identify each set of procedures.
3. Prepare text specific to this project. Preprinted text and brochures may be used to supplement text specific to this project if the text specific to this project contains reference, or references, to the preprinted material and if the preprinted material has been annotated to clearly show the part, or parts of the preprinted material that are applicable to this project.
4. Text character height shall not be less than 8 points or more than 12 points. Larger size letters may be used for headings. Pitch shall be between 10 characters per inch and 16.66 characters per inch. The pitch may be less than 10 characters per inch in headings. Select character point and pitch to produce text, which is easy to read. Select a font style which is easy to read.

F. Illustrations

1. Provide illustrations as required to clearly present instructions, clarify the text, or both. Place illustrations so that the illustrations are in a logical relationship to the text.
2. Pages of the O&M Data may contain text, illustration, or text and illustrations. Preprinted illustrations and brochures containing illustrations may be used if the preprinted illustrations are applicable to this project or the preprinted illustrations are annotated to clearly show the illustrations or parts of illustrations that are applicable to this project.

G. Drawings

1. Provide drawings for each system in the O&M Data. Drawings shall show the
relationship between the various components in each system and the equipment installed in each system. If there is fluid flow within a system, the drawings for the system shall include a flow diagram. If there is electrical power, control wiring, or both in a system, the drawings for the system shall include a wiring diagram, a control diagram, or both as applicable.

2. Identify systems, components, and enclosures on the O&M Data drawings. Present definitions of all abbreviations and symbols used on the O&M Data drawings.

3. Identify wire and terminal numbers on all wiring diagrams.

4. Drawings shall be specific to this project. Standard drawings may be used in the O&M data if the drawings are revised for this project.

H. Quality Assurance

1. Personnel who assemble the O&M Data and the Facility Manual shall be familiar with requirements of this Section.

2. O&M Data shall be written by, edited by, or written and edited by personnel skilled in technical writing to the extent required to communicate essential data.

3. Drawings, diagrams, figures, and illustrations shall be prepared by skilled draftsmen or CADD operators competent to prepare required. Drawings.

2.02 REPRODUCTION

A. Text and drawings, sketches and diagrams used for illustrations shall be on 8-½" x 11" paper, 20-lb. minimum. Do not use sensitized paper.

B. Photo prints shall be securely mounted on 8-½ x 11" backing or shall be mounted in sheet protectors. Photo print backing shall be heavy paper, 90-lb. minimum, card stock, or equal. Sheet protectors shall be non-glare, clear vinyl.

C. Drawings shall be 8-½" x 11", 11" x 17", or larger. Drawings 8-½" x 11" and 11" x 17" shall be bound together with text and shall have reinforced holes. Drawings larger than 11" x 17" shall be folded and placed in pockets which are bound together with text or inside the back cover of the binder.

D. Text and illustrations shall be originals, offset printed, photo prints, or first quality machine copies. Text and illustrations shall be crisp with a uniform background. If originals have characters, lines, or shading which are a color, or colors, other than black or the medium is a color, or colors other than white, provide machine color copies.

E. Drawings shall be offset printed, blue line prints, black line prints, or first generation machine copies. Drawings shall be crisp with a uniform background. If originals have lines, characters, symbols, or shading which are a color, or colors, other than black, provide offset prints of drawings.

PART 3 – EXECUTION
3.01 TRAINING OF OWNER'S PERSONNEL

A. Fully instruct Owner's designated operating and maintenance personnel in the operations, maintenance, adjustment, and calibration of products, equipment, and systems if specified in the applicable Section of the Specifications. The requirements for the training are described in Section 01660 – Material and Equipment.

B. Use the O&M Data as the basis of instruction.

1. Review contents of manual with personnel in full detail.
2. Explain all aspects of operation and maintenance.

END OF SECTION
SECTION 02130
TERMITE CONTROL

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals: Product Data and product certificates for each type of product indicated. Include the EPA-Registered Label.

B. Installer Qualifications: A specialist who is licensed according to regulations of authorities having jurisdiction to apply termite control treatment and products in jurisdiction where Project is located, and who employs workers trained and approved by manufacturer to install manufacturer's products.

C. Regulatory Requirements: Formulate and apply termiticides and termiticide devices according to the EPA-Registered Label.

D. Continuing Service: Provide 12 months continuing service including monitoring, inspection, and re-treatment for occurrences of termite activity.

PART 2 - PRODUCTS

2.1 TERMITE CONTROL PRODUCTS

A. Soil Treatment Termiticide: Provide an EPA-registered termiticide complying with requirements of authorities having jurisdiction, in an aqueous solution.

1. Service Life of Treatment: Soil treatment termiticide that is effective for not less than five years against infestation of subterranean termites.

B. Wood Treatment with Borate: Provide an EPA-registered borate termiticide complying with requirements of authorities having jurisdiction.

C. Bait Station System: Provide bait stations based on the dimensions of building perimeter indicated on Drawings, according to manufacturer's EPA-Registered Label for product, manufacturer's written instructions, and the following:

1. No fewer than one bait station per 20 linear feet (6.1 linear meters).

D. Metal Mesh Barrier System: Stainless-steel mesh, 0.025-by-0.018-inch (0.64-by-0.45-mm), made from 0.08-inch- (2.0-mm-) diameter, Type 316 stainless-steel wire.

E. Polymer Sheet Barrier System: 16-mil- (0.40-mm-) thick, multilayered, laminated, polymer sheet with lambda-cyhalothrin termiticide sealed between two outer polymer layers.
F. Polymer Barrier Fittings: Integral 2-1/2-inch- (65-mm-) long polymer sleeve and 1-inch- (25-mm-) wide circular flange with lambda-cyhalothrin termiticide sealed between two outer polymer layers; with fasteners.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Comply with requirements of authorities having jurisdiction and with manufacturer's EPA-Registered Label for products.

B. Soil Treatment Application: Provide quantity required for application at the label volume and rate for the maximum specified concentration of termiticide, according to manufacturer's EPA-Registered Label, to the following so that a continuous horizontal and vertical termiticidal barrier or treated zone is established around and under building construction:
   1. At foundations.
   2. Under concrete floor slabs-on-grade.
   3. Under basement floor slabs.
   4. At hollow masonry.
   5. At expansion and control joints and slab penetrations.
   6. At crawlspace; treat soil under and adjacent to foundations. Treat adjacent areas including around entrance platform, porches, and equipment bases.

C. Post warning signs in areas of soil treatment application.

D. Reapply soil termiticide treatment solution to areas disturbed by subsequent excavation or other construction activities following application.

E. Wood Treatment Application: Provide quantity of borate solution required for application at the label volume and rate for the maximum specified concentration of borate, according to manufacturer's EPA-Registered Label, so that wood framing, sheathing, siding, and structural members subject to infestation receive treatment.

F. Installing Bait Station Systems: Place bait stations and, if applicable, monitoring stations, according to the EPA-Registered Label for the product and manufacturer's written instructions.
   1. Inspect and service bait stations during time specified for continuing service, according to the EPA-Registered Label for product and manufacturer's written instructions.

G. Metal Mesh Barrier: Place metal mesh barrier where indicated to provide a continuous barrier to entry of subterranean termites. Install mesh under the perimeter of concrete slab edges and joints after vapor barrier and reinforcing steel are in place. Fit mesh tightly around pipe or other penetrations.
H. Install polymer sheet barrier system according to manufacturer’s EPA-Registered Label to provide a complete and continuous barrier to entry of subterranean termites.

I. Install polymer barrier fittings around each utility pipe and conduit penetrating concrete slab and foundation walls]according to the EPA-Registered Label for the product and manufacturer's written instructions.

END OF SECTION
SECTION 02220
DEMOLITION

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Removal of structures, equipment, piping, wiring, and other existing materials, wholly or in part, as required to complete Work as shown on the Drawings and specified in this Section.

B. Removal and salvaging of designated equipment, materials, and piping. Disposal of rubble, debris, equipment, piping, wiring, and other materials removed.

C. Special requirements to locate embedded conduit in concrete structures receiving partial or spot demolitions.

1.02 SUBMITTALS

A. General: as specified in Section 01330 - Submittals

B. Submit the following:

1. Proposed methods for demolition;
2. Equipment proposed to be used to do demolition work;
3. Demolition schedule/sequence.

1.03 PROJECT/SITE CONDITIONS

A. General

1. Refer to Sections 0110 and 01120 for requirements regarding phasing of the demolition work.

2. Execute demolition so that there is no injury to persons or damage to adjacent buildings, structures, equipment, materials, piping, wiring, pavement, fences, guardrails, and other adjacent improvements. Execute demolition so that access to facilities that are in operation is free and safe.

3. Execute demolition so that interference to vehicular traffic and personnel traffic does not exceed scheduled interference. Do not place rubble, debris, equipment, piping, wiring, pavement, fencing, or other materials removed on roadways, drives, or sidewalks that are to remain in service.

B. Dust Control
1. Control dust resulting from demolition so that dust does not spread to occupied portions of buildings and to facilities in service.

2. Control dust resulting from demolition so that no nuisance is created in areas surrounding the project site.

PART 2 - PRODUCTS

2.01 TEMPORARY MATERIALS

A. Provide temporary fencing, barricades, barriers, and enclosures to meet the requirements of this Section.

B. Temporary fencing, barricades, barriers, and enclosures shall be suitable to the purpose intended.

2.02 REPAIR AND REPLACEMENT MATERIALS

For repair or replacement of existing work to remain, use materials identical to, or equal to, materials used in existing work when new.

PART 3 - EXECUTION

3.01 GENERAL

A. Conduct demolition as shown and specified in the Contract Documents.

B. Conduct demolition so that existing equipment, piping, wiring, structures, and other improvements to remain are not damaged. Repair or replace equipment, piping, wiring, structures, and other improvements damaged at no additional cost to the Owner.

C. Do not remove equipment, piping, wiring, structures, or other improvements not shown or specified to be removed. If equipment, piping, wiring, structures, or other improvements not shown or specified to be removed is removed, replace equipment, piping, wiring, structures, or other improvements at no additional cost to the Owner.

3.02 PROTECTION OF CONDUIT AND CONDUCTORS

A. It is the Contractor’s responsibility in existing structures that receive partial or spot demolition, to protect embedded conduit and conductors. The Contractor shall use non-destructive imaging methods (radar, x-ray, etc.) to locate embedded conduit in concrete prior to demolition, saw cutting and core drilling. Relocate, repair and reconstruct functional conduits and conductors affected by the demolition.

3.03 DISCONNECTIONS
A. Prior to starting demolition, check underground and exposed existing utilities, piping, and equipment within the limits of demolition. Prior to starting demolition, check underground and exposed existing utilities, piping, wiring, and equipment connected to and associated with buildings, structures, equipment, materials, piping, wiring, pavement, fences, guardrails, and other existing improvements to be removed. Verify the following:

1. Piping is inactive (abandoned);
2. Electrical power to equipment, lighting, controls, and other facilities has been permanently or temporarily disconnected, if required;
3. Utilities have been permanently disconnected or temporarily if required;

B. Do not proceed with salvage or demolition if piping is active, electrical power has not been disconnected, or utilities have not been disconnected.

3.04 EMBEDDED ANCHORS, REBAR AND FASTENERS

A. Remove all anchors, fasteners, reinforcing steel or similar devices embedded in concrete and associated with equipment, piping and materials to be removed or demolished.

B. Chip around each anchor, fasteners, reinforcing steel or similar device to allow removal of the embedded material 0.5 inches from the surface for concrete not in continuous contact with water or earth and 1.5 inches from the surface for submerged or buried concrete surfaces or as directed by the Engineer. Coat exposed reinforcing steel with corrosion inhibitor. Repair concrete with Sikatop 122 plus or approved equal. Provide exposed finish surface to match adjacent surface texture and color.

3.05 SALVAGE OF EQUIPMENT, PIPING, AND MATERIALS

A. Remove items identified on the drawings, or specified, to remain the property of the Owner. Do not damage equipment, piping, and materials to be salvaged.

B. Following removal or equipment, piping, and materials to be salvaged, place equipment, piping, and materials in a location designated by the Owner.

3.06 REPAIRS

Repair structural elements, equipment, piping, conduit, and other improvements to remain that are damaged during demolition. Use workers specifically qualified in trade, or trades, involved to repair damaged work.

3.07 DISPOSAL

A. Remove equipment, piping, and materials not specifically designated to be retained by the Owner from the project site as Contractor’s property.

B. Contractor shall not accumulate or store debris from demolition on the project site.
3.08 FILLING

A. Backfill excavations, trenches, craters, holes, and pits resulting from demolition and below ground, abandoned remains of partially demolished structures. Do not use debris in backfill.

B. Backfill beneath new structures and pavement as specified in Section 02316 - Structural Earthwork

C. Backfill pipe trenches as specified in Section 02317 - Trenching, Bedding and Backfilling for Pipe.

D. Backfill in open yard areas as specified in Section 02315 - Site Earthwork.

3.09 CLEANUP

A. Following demolition, clean-up areas where other work is to be done as specified in this Section, or Sections applicable to work to be done.

B. Following demolition, clean-up areas where no other work is to be done under this Contract. Remove debris and rubbish, temporary facilities, and equipment. Level surface irregularities to eliminate depressions. Leave work in a neat and presentable condition.

END OF SECTION
SECTION 02230
CLEARING, GRUBBING AND STRIPPING

PART 1 - GENERAL

1.01 SECTION INCLUDES
Clearing, grubbing, stripping and related work necessary to complete Work as shown on the Drawings and specified in this Section.

1.02 DEFINITIONS
A. Clearing: Cutting, removal, and proper disposal of trees, stumps, brush, shrubs, rubbish, and other material as required to construct improvements as shown and specified.

B. Grubbing: Removal and disposal of stumps larger than 1/2” in diameter and other similar items to a depth of not less than 12” below finish grade.

C. Stripping: Removal and disposal of sod, topsoil, grass, roots and other material.

PART 2 - PRODUCTS (not used)

PART 3 - EXECUTION

3.01 CLEARING, GRUBBING AND STRIPPING
A. Clear, grub and strip areas to be occupied by new constructed facilities including ponds, ditches, berms and areas to be excavated, filled, paved, or planted as shown on the Drawings.

B. Clear and grub right-of-way as required to complete project. Clear and grub easements as required to complete project. Do not clear or grub more than required to complete project.

C. Designated trees on the project site shall be removed and relocated by the Owner.

3.02 PROTECTION OF EXISTING AND ADJACENT AREAS
Protect areas shown on the Drawings, or designated by the Engineer, from damage by construction operations as specified in Section 01150 – Protection of Existing Facilities.

3.03 DISPOSAL
A. Remove roots, vegetation, and other debris from the site. Dispose of roots, vegetation, and other debris removed from the site.

B. Stockpile topsoil for later use in landscaping as directed by the Engineer.

C. Do not burn any material on the site or other areas where burning is not permitted.

END OF SECTION
SECTION 02240
DEWATERING

PART 1 - GENERAL

1.01 SECTION INCLUDES

Requirements for dewatering excavations and trenches.

1.02 DESCRIPTION OF ACTIVITIES INCLUDED

A. Obtain permits required by regulatory authorities having jurisdiction and required by the Owner for installation, operation, and removal of dewatering systems.

B. Furnish and install dewatering systems including well points, wells, pumps, piping, chemical grouting, water tight sheeting, ground freezing, tremie wall, or any other technology as may be necessary to accomplish dewatering in a safe and proper manner.

C. Provide labor, equipment, and services required to operate dewatering systems.

D. Remove dewatering systems.

E. Plug and seal dewatering wells.

1.03 SUBMITTALS

A. General: As specified in Section 01410 – Regulatory Requirements and Section 01330 – Submittals.

B. Dewatering Plan: Contractor shall prepare and submit dewatering plan for each dewatering system. Dewatering plan shall be submitted prior to installation and shall include the following:

1. Groundwater data and assumptions relating to groundwater conditions.

2. Description of proposed dewatering system with drawings, diagrams, and system component data as applicable.

3. Proposed measures to insure dewatering system reliability.

4. Description of discharge water disposal methods.

5. Identification and location of private water supply wells, public water supply wells, lakes, and ponds that may be affected by dewatering.

6. Anticipated affect upon private water supply wells, public water supply wells, lakes, and ponds that may be impacted by dewatering. Proposed measures to ameliorate effects of dewatering upon private water supply wells, public water supply wells, lakes, and ponds.

7. Other data pertinent to the dewatering system.

C. Dewatering Permit: Submit copy of dewatering permit prior to installing dewatering system or systems.
1.04 JOB SITE CONDITIONS

A. Noise Limitations.
   1. Noise levels at the property line of the project shall not exceed local noise ordinances.
   2. Provide mufflers on engines and sound attenuating enclosures as required to meet the noise restrictions.
   3. Modify dewatering system, or systems, as required to comply with ordinances regulating noise.

B. Damage Prevention
   1. Dewatering systems shall be constructed to avoid existing or new structures and improvements of existing structures. Repair or replace structures damaged by settlement caused by dewatering.
   2. Discharge from dewatering systems shall not cause erosion of turf or soil. Replace turf or soil damaged by dewatering discharge. Replace soil displaced by dewatering discharge.
   3. Discharge from dewatering systems shall not damage landscaping. Replace landscaping damaged by dewatering discharge.
   4. Modify dewatering system, or systems, as required to eliminate conditions that cause damage.

C. Access
   1. Dewatering systems and dewatering system operations shall not prevent emergency access or prevent persons living in the vicinity of construction from completing their normal daily pursuits.
   2. Provide temporary access over dewatering system piping for vehicular and pedestrian traffic.

D. Water Supply: Dewatering shall not impact private water supply wells or public water supply wells.

E. Lake and Pond Level: Dewatering shall not impact lake levels and pond levels.

**PART 2 - PRODUCTS**

2.01 DEWATERING SYSTEM

Contractor shall be responsible for the sizing and selection of dewatering system, dewatering equipment, dewatering system piping, and appurtenances.

**PART 3 - EXECUTION**

3.01 GROUNDWATER

Contractor shall be responsible for evaluating and determining groundwater conditions.
3.02 DEWATERING SYSTEMS

A. Provide, operate, and maintain dewatering systems including well points, wells, chemical grouting, water tight sheeting, ground freezing, tremie wall, or any other technology as may be necessary to accomplish dewatering in a safe and proper manner.

B. Provide dewatering systems that control groundwater level in conformance with the requirements of this Section. Provide dewatering systems that lower groundwater to level shown, specified, or shown and specified in advance of excavation. Provide dewatering systems that continuously maintain groundwater level at, or below, level shown, specified, or shown and specified until backfilling and compaction have been completed to level shown, specified, or shown and specified.

C. Provide automatic starting devices, standby pumps, and other equipment and controls required to provide continuous dewatering in the event of an outage of dewatering pump or other dewatering system component.

D. Provide headers, suction piping, and discharge piping as required to convey water from well points, dewatering wells, and caissons to dewatering system discharge point designated in permit and accepted dewatering plan.

E. Modify dewatering system during the course of construction as conditions that affect dewatering change.

3.03 DEWATERING OPEN EXCAVATIONS AND TRENCHES

A. Lower groundwater to level shown, specified, or shown and specified in advance of excavation. Provide monitoring wells or other means to measure groundwater level prior to starting excavation.

B. Dewater excavations and trenches from outside the limits of excavations and trenches. Dewater excavations and trenches from below the bottom of excavations and trenches.

C. Dewater excavations for cast-in-place structures to a minimum level of three feet below structural grade.
   1. Maintain water level a minimum of three feet below structural grade until backfilling is complete.
   2. Maintain dewatering system in operation as required to prevent structures from being displaced by hydrostatic pressure until final acceptance of the Work.

D. Dewater trenches to a minimum level of 12 inches below excavated trench bottom. Maintain water level a minimum of 12 inches below excavated trench bottom until backfill meets the following requirements:
   1. Backfilling and compaction have progressed as to a depth that installed piping will not be displaced by hydrostatic pressure.
   2. Backfilling and compaction have been completed above natural water table to a level that remaining backfill can be placed and compacted as specified in Section 02317-Trenching, Bedding and Backfill for Pipe.

E. Dewatering measures shall provide the following:
1. Prevent instability of excavations and trenches due to groundwater.
2. Prevent the disturbance of subgrade bearing materials due to groundwater.
3. Keep excavations and trenches free from standing water and running water.
4. Prevent tanks, pipes, and other structures from being displaced by hydrostatic pressures.

F. Do not install or operate dewatering systems that allow movement of soil through excavation or excavation subgrade. Do not install or operate dewatering systems that allow movement of soil through trench or trench subgrade.

G. Do not install or operate dewatering systems that allow movement of soil from beneath existing or previously installed structures or pipes.

3.04 DEWATERING DISCHARGE CONTROL

A. Discharge water from dewatering system to storm drain systems in accordance with dewatering permit and as specified in this Section. Provide silting basins and other discharge treatment systems in accordance with dewatering permit and to meet discharge permit requirements.

B. Do not allow discharge from dewatering system to puddle or pond on construction site except in areas designated and approved to receive discharge from dewatering system.

C. Do not allow discharge from dewatering system to flow off construction site except through permitted discharge structures and through pipes, conduits, and channels that have been designated and approved for discharge flow from dewatering systems.

D. Do not use sanitary sewers for disposal of water from water control systems. Do not use sanitary sewer system under construction as conduit to remove ground water from trench.

E. Do not discharge water containing settleable solids into storm sewers.

F. Do not contaminate or disturb the environment of properties adjacent to the Work.

G. Do not contaminate streams or other surface waters.

H. Provide temporary facilities and controls for dewatering system discharge. Temporary facilities and controls shall be appropriate to the project, including, but not limited to:
   1. Silting basin, or basins, of adequate size.
   2. Filters.
   3. Coagulants.
   4. Screens.

I. Discharge onto pavement shall not damage pavement.

3.05 DEWATERING SYSTEM REMOVAL AND CLEANUP

A. Completely remove dewatering systems installed for construction.
B. Remove or Plug and seal dewatering wells after dewatering operations are concluded. Plug and seal dewatering wells in accordance with permit requirements.

C. Remove and dispose of solids, including sand, mud, and other material, discharged from dewatering systems.

END OF SECTION
SECTION 02310
EROSION AND SEDIMENTATION CONTROL

PART 1 - GENERAL

1.01 SECTION INCLUDES

Requirements for erosion and sedimentation control.

1.02 SUBMITTALS

A. General: As specified in Section 01330 – Submittals and Section 01410 – Regulatory Requirements

B. Submit copy of approved Erosion Control Plan (Storm Water Pollution Prevention Plan) to the Engineer prior to installing erosion and sedimentation control measures.

1.03 EROSION CONTROL PLAN

A. Contractor shall be responsible for erosion and sedimentation control.

B. The Contractor shall prepare an Erosion Control Plan that will include structures, locations, maintenance schedules, operational requirements and other measures that will be taken to control erosion.

C. The Erosion Control Plan shall include management of all anticipated non-stormwater discharges such as dewatering and line flushing.

D. The Erosion Control Plan shall include all phases of construction anticipated.

E. Drawings showing locations and details of structures shall be included as necessary to show the proposed measures.

PART 2 - PRODUCTS

2.01 MATERIALS FOR EROSION AND SEDIMENT CONTROL

All materials shall comply with Section 104-6 of the Florida Department of Transportation Standard Specifications for Road and Bridge Construction and local regulations.

PART 3 – EXECUTION

3.01 All construction, maintenance, and removal of erosion control structures shall comply with Sections 104-6 to 104-8 of the Florida Department of Transportation Standard Specifications for Road and Bridge Construction and local regulations.

END OF SECTION
SECTION 02315
SITE EARTHWORK

PART 1 - GENERAL

1.01 SECTION INCLUDES

Requirements for construction of embankments shown on the Drawings, grading of site to elevations, lines, slopes, depths and cross-sections as shown on the Drawings, and placing, compaction, and testing of fill as specified in this Section.

1.02 REFERENCES

A. ANSI/ASTM Standards
   1. ANSI/ASTM D698 (AASHTO T-99) Moisture-Density Relations of Soils and Soil Aggregate Mixture Using 5.5 lb. (2.49 kg) Rammer and 12 inch (305mm) Drop
   2. ANSI/ASTM D1557 (AASHTO T-180) Moisture-Density Relations of Soils and Soil Aggregate Mixture Using 10 lb. (4.54 kg) Rammer and 18 inch (457 mm) Drop

B. ASTM Standards
   ASTM D2922 Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Method (Shallow Depth)

C. Occupational Safety and Health Administration
   Excavation Safety Standards, 29 CFR.1926.650, Subpart P.

D. Collier County DOT Standards and Utilities Standards Manual, latest editions with revisions.

1.03 ROCK

Rock excavation is anticipated and shall not be considered as classified. No additional Contract Time or Cost will be allowed for rock excavation.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Suitable Fill Material: Non-cohesive, non-plastic, granular mixture of local sand and limerock, free from vegetation, organic material or muck. Suitable fill material shall contain not more than 8% material by weight passing No. 200 sieve, nor more than 10% rock larger than two inches (2”). Suitable fill material containing limerock shall have sufficient sand to fill voids in limerock.
B. Unsuitable Fill Material: Topsoil from ground surface to a depth of six inches or as determined by Engineer; material classified as A-8 in accordance with AASHTO Designation M145 or material considered highly organic soil (peat or muck) as determined by Engineer.

PART 3 - EXECUTION

3.01 INSPECTION

A. Verify site conditions and note irregularities affecting work of this Section.

B. Beginning work of this Section means acceptance of existing conditions.

3.02 EXCAVATION

A. General

1. Locate underground structures and utilities in areas of work to avoid conflicts with existing facilities. Do not operate excavation equipment within five (5) feet of existing structures or newly completed structures. Excavate with hand tools in these areas. Where conflicts are unavoidable, perform work so that interference with service rendered or facility disturbed is minimized.

2. Strip existing surfaces to be excavated to a depth of six inches, unless otherwise directed by Engineer, to remove grass, roots and other vegetation. Stripped material is considered unsuitable for general fill purposes. Use stripped material only as topsoil.

3. Dewater excavations if necessary, as specified in Section 02240 – Dewatering.

4. Use suitable materials removed from excavation areas as far as practicable in the formation of embankments. Stockpile topsoil and other suitable materials in areas as directed by Engineer.

5. Remove unsuitable material and excess excavated suitable material from the Project. Dispose of unsuitable material and excess excavated suitable material off the Project.

B. Protection

1. Before commencing Work under this Section, protect existing structures and utilities in accordance with Section 01150 – Protection of Existing Facilities.

2. Protect excavations by shoring, bracing, sheet piling, underpinning or other methods required to prevent cave-in or loose soil form falling into the excavation. Excavations slopes, shoring, bracing, sheet piling, underpinning or other methods shall conform with the Florida Trench Safety Act and 29 CFR 1926.50, Subpart P. If sheeting is used, sheeting may be removed provided removal can be accomplished without disturbing bedding, pipe or
alignment. Should Engineer determine that removal of sheeting will damage pipe, the sheeting shall be left in place at no additional cost to the Owner. If left in place, cut sheeting off two feet (2’) above top of pipe and leave sheeting in place below cut. Any damage to pipe bedding, pipe, or alignment caused by removal of sheeting shall be cause for rejection of the affected portion of the Work.

3. If sheeting is used, Contractor submit calculations and drawings prepared and sealed by a Florida P.E. to the Engineer for approval prior to commencement of sheeting operations. All sheeting shall be designed to accommodate ground water loading based on the normal groundwater table and without consideration of dewatering activities.

4. Provide barricades, warning signs, and lights as required by law or regulation.

5. Underpin adjacent structures and utilities, including utility services, which may be damaged by excavation work.

6. Notify Engineer of unexpected subsurface conditions and discontinue work in affected area until notified by Engineer to resume work. Take emergency measures as required to protect persons and improvements.

C. Repair

1. Repair damage caused to existing structures and utilities in accordance with Section 01160 – Alteration of Existing Facilities.

2. Repair facilities or structures damaged during prosecution of Work immediately.

3.03 ROCK EXCAVATION

A. Use non-explosive methods for rock removal.

B. Maximum dimension of rock removed shall not exceed three feet.

C. Remove rock from site.

3.04 FILL

A. Provide fill material from excess on-site excavated suitable fill or from off-site sources.

1. If there is not sufficient on-site excavated suitable fill required to complete Work, provide suitable fill from off site.

2. Borrow areas or other sources of off-site material shall be accessible to examination by the Engineer prior to, and during, use of off-site material.

B. Use only suitable fill material in formation of embankments.
C. Place fill material in lifts not to exceed eight inches. Compact fill material in general areas to density not less than 95% of maximum dry density as determined by ASTM D698 (AASHTO T-180). Compact fill under paved areas and structures to density not less than 98% of maximum dry density per ASTM D698. During compaction of fill material, moisture content of fill material shall be within plus or minus 2% of optimum moisture content. If necessary, add water or allow material to dry until the proper moisture content for the specified compaction is obtained. Allow testing of each compacted fill layer, in place, prior to placement of succeeding fill layers.

D. Perform filling work in accordance with Section 120 of FDOT Standard Specifications, in locations shown on the Drawings.

3.05 TESTING

A. Utilize a laboratory as specified in Section 01430 – Materials Testing.

B. Perform one Proctor Test according to ASTM D698 or ASTM D1557 for each source of fill, as determined by Engineer, used on the Project.

C. Test the density of each compacted fill layer in place by field density test ASTM D2922.
   1. Perform at least one test for each 1,000 square feet of site fill, or fraction thereof.

D. Perform additional field tests for each test that does not meet the required density.

E. Excavate and recompact areas that do not meet the requirements of this specification.

3.06 FINE GRADING

A. Fine grade disturbed areas of site after structures, bases, and pavements are completed and yard piping trenches are backfilled.

B. Remove construction debris in areas to be fine graded prior to fine grading.

C. Shape and slope completed surface to drain away from structures. Completed surface shall be within 0.1 foot of finish elevations, contours, or elevations and contours shown on the Drawings.

D. Perform survey of finished site, in accordance with Section 01541 – Field Engineering, to determine conformance of the final earthwork with the Drawings. Submit certified survey as part of Record Drawings. See Section 01781 – Project Record Documents.

END OF SECTION
SECTION 02316
STRUCTURAL EARTHWORK

PART 1 - GENERAL

1.01 SECTION INCLUDES

Requirements for earthwork materials and procedures to produce an acceptable foundation for structures as shown on the Drawings and specified in this Section.

1.02 REFERENCES

A. ANSI/ASTM Standards

1. ASTM D698 (AASHTO T-99) Moisture-Density Relations of Soils and Soil Aggregate Mixture Using 5.5 lb. (2.49 kg) Rammer and 12 inch (305mm) Drop

2. ANSI/ASTM D1557 (AASHTO T-180) Moisture-Density Relations of Soils and Soil Aggregate Mixture Using 10 lb. (4.54 kg) Rammer and 18 inch (457 mm) Drop

B. ASTM Standards

ASTM D2922 - Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Method (Shallow Depth)

C. State of Florida

Florida Trench Safety Act (90-96, Laws of Florida)

D. Occupational Safety and Health Administration

Excavation Safety Standards, 29 CFR.1926.650, Subpart P.

E. Collier County DOT Standards and Utilities Standards Manual, latest editions with revisions.

1.03 SUBMITTALS

A. General: As specified in Section 01330 – Submittals

B. Prior to starting earthwork, submit sieve analysis and Proctor test results of the existing stripped soils and the proposed fill material to Engineer for review and approval.

C. Prior to starting excavation submit a Plan for Excavation as specified in this Section.

D. Submit vibratory roller technical specifications for review and approval to the
Engineer prior to shipment of vibratory roller to site.

1.04 QUALITY ASSURANCE

A. All Contractor and Subcontractors: Company specializing in respective field work with five (5) years of documented experience.

B. Coordinate all activity with a testing laboratory experienced in soils and foundations as specified in Section 01430 – Materials Testing.

C. Contractor shall satisfy himself as to the character and amount of different soil materials, groundwater and the subsurface conditions to be encountered in the work to be performed. Information and data, when furnished, are for the Contractor's general information. However, it is expressly understood that any interpretation or conclusion drawn there from is totally the responsibility of the Contractor. Engineer assumes no liability for the accurateness of the data reported.

1.05 ROCK

Rock excavation is anticipated and shall not be considered as classified. No additional Contract Time or Cost will be allowed for rock excavation.

PART 2 – PRODUCTS

2.01 SYSTEM DESCRIPTION

Structural Earthwork shall be soil beneath structures. The limits of the structural earthwork shall be within the limits described by proceeding 6 feet horizontally from the base of the structure, then at a slope of 2H/1V downward to existing competent soils.

2.02 MATERIALS

A. Suitable Fill Material

1. Suitable material shall be non-cohesive, non-plastic, granular mixture of clean, coarse sand free from vegetation, organic material, marl, silt or muck.

2. Suitable material shall contain no more than 8% material by weight passing the No. 200 sieve.

B. Unsuitable: Topsoil from ground surface to a depth of six inches or as determined by the Engineer; material classified as A-2-4, A-2-5, A-2-6, A-2-7, A-4, A-5, A-6, A-7 and A-8 in accordance with AASHTO Designation M145 or material considered highly organic soil (peat or muck) as determined by Engineer.

C. Select Material: Suitable material that does not contain any rock larger than ½ - inch.
D. Gravel Base: Washed coarse #67 aggregate for concrete with fines not more than five percent passing through the No. 200 sieve or FDOT #89 stone.

2.03 VIBRATORY ROLLER

Vibratory Roller shall be a self-propelled minimum two-ton drum type vibratory roller.

PART 3 – EXECUTION

3.01 SITE PREPARATION

A. Clean and grub surface vegetation as specified in Section 02230 – Clearing, Grubbing and Stripping.

B. If unsuitable bearing soils, peat or muck are encountered, contact Engineer for further direction.

C. If ground water is within twenty-four inches from the ground surface, it shall be necessary to dewater. Dewater as specified in Section 02240 – Dewatering.

3.02 EXCAVATION

A. Dewatering: If necessary, dewater excavations for cast-in-place structures to a maximum water surface elevation of three (3) feet below structural grades as described in Section 02240 – Dewatering.

B. Plan for Excavation

1. Contractor shall be responsible for having determined to his satisfaction, prior to the submission of his bid, the conformation of the ground, the character and quality of the substrata, the types and quantities of materials to be encountered, the nature of the groundwater conditions, the prosecution of the work, the general and local conditions and other matters which can in any way affect the work under this Contract.

2. Prior to commencing the excavation, the Contractor shall submit a Plan for Excavation that describes his proposed operations to the Engineer for approval.

3. Contractor shall consider, and his plan for excavation shall reflect, the equipment and methods to be employed in the excavation.

C. Protection

1. Protect excavations by shoring, bracing, sheet piling, underpinning or other methods required to prevent cave-in or loose soil form falling into the excavation. Excavations slopes, shoring, bracing, sheet piling, underpinning or other methods shall conform with the Florida Trench Safety Act and 29 CFR 1926.50, Subpart P. If sheeting is used, sheeting may be removed provided removal can be accomplished without disturbing bedding, pipe or alignment. Should Engineer determine that removal of sheeting will damage pipe, the sheeting shall be left in place at no additional cost to the Owner. If left in place, cut sheeting off two feet...
(2′) above top of pipe and leave sheeting in place below cut. Any damage to pipe bedding, pipe, or alignment caused by removal of sheeting shall be cause for rejection of the affected portion of the Work.

2. If sheeting is used, Contractor submit calculations and drawings prepared and sealed by a Florida P.E. to the Engineer for approval prior to commencement of sheeting operations. All sheeting shall be designed to accommodate ground water loading based on the normal groundwater table and without consideration of dewatering activities.

3. Provide barricades, warning signs, and lights as required by law or regulation.

4. Protect adjacent facilities as described in Section 01150 – Protection of Existing Facilities.

5. Notify Engineer of unexpected subsurface conditions and discontinue work in affected area until notified by Engineer to resume work. Take emergency measures as required to protect persons and improvements.

D. Excavation for Structures

1. Excavation for precast or prefabricated structures shall be carried to an elevation 1-foot lower than the proposed outside bottom of the structure to provide space for the select gravel backfill material. Prior to placing the select gravel backfill, the excavation shall be sounded, if not dewatered, using a rigid pole to indicate to the satisfaction of the Engineer that the excavation has been carried to the proper depth and is reasonably uniform over the area to be occupied by the structure.

2. Carry down excavation for structures constructed or cast in place in dewatered excavations to bottom of structure where dewatering methods are such that a dry excavation bottom is exposed. Naturally occurring material at this elevation shall be leveled and left ready to receive construction. Replace material disturbed below the described final elevation in dewatered excavations with Class B concrete.

3. Excavate footings as specified in this Section. Footing sides shall be formed immediately after excavation. Forming for footing sides is specified elsewhere.

3.03 FOUNDATION PREPARATION (FILLING, BACKFILLING)

A. Compact exposed stripped and/or excavated surface for buildings by means of an approved heavy vibratory roller until eight passes have been made and a soil density of 98 percent of maximum modified Proctor Density has been achieved twelve inches below the exposed compacted surface. Test compaction as specified. Add water if necessary to bring up moisture to optimum levels.

B. Compact existing ground beneath the structural slabs to a density of not less than 98 percent of its maximum density as determined by ASTM D-1557 for a depth of not less than 2 feet below bottom of concrete slabs. Remove unsuitable foundation material and replace with suitable material.

C. Buildings: After precompaction of the stripped building area, place approved fill material within the limits of structural fill as described in this section. Place fill in lifts of 8-inch maximum loose thickness, each lift compacted and fill brought to approximate
underside of slab. Compact each lift to a minimum of 98 percent Modified Proctor 12 inches below the surface.

D. Excavation for building footings and wet well work slab/base slab shall be made through precompacted soils/building pad to design elevations. Bottom of excavation shall be additionally compacted to 98% of Proctor Density 12-inches below the surface by portable vibratory sled type of compactors. Test compaction as specified.

E. Building Slab Backfill: Place fill inside the building foundation walls in lifts of 6-inches maximum loose thickness, each lift compacted with vibratory portable compactors and fill brought to bottom of the slab. Add necessary water to each lift to bring moisture content to optimum levels and compacting to achieve a minimum of 98 percent of modified Proctor Density.

F. Form monolithic slab beams by excavating from the compacted fill material to grades and lines indicated on the drawings.

G. Place backfill around foundation slabs, walls, utility trenches, mechanical and plumbing pipes, and other items in layers of six inches maximum loose thickness and compact with portable plate compactors to achieve a minimum of 98 percent of Modified Proctor Density as per ASTM D-1557.

H. Equipment Pads and Slabs on Grade: Cut, fill and compact subgrades for concrete slabs to required grade. Compact top 8-inches of concrete slab subgrade in cut sections and fill material to a density of not less than 98 percent of its maximum density as determined by ASTM D-1557.

I. Vibratory compaction shall not be done on dry sandy material or when water table is within eighteen inches of the surface. Before start of vibratory compaction, the soils should either have natural moisture or applied water to bring the soils to optimum moisture content.

3.04 SITE GRADING AND FILLING OUTSIDE STRUCTURES

Perform site earthwork as specified in Section 02315 – Site Earthwork.

3.05 TESTING

A. Notify the materials testing laboratory in time to be on hand to make the tests required by these specifications.

B. Perform Proctor Tests according to ASTM D698 or ASTM D1577 for the existing stripped area and each source of fill as follows:

   1. Existing stripped area: Perform one test, minimum
   2. Fill source: For each source of fill, perform one test for every 500 cubic yards of fill.

C. Test the density of each compacted fill layer in place by field density test ASTM D2922 as follows:
1. Stripped Area: Perform one test every 750 square feet (perform a minimum of 2 tests).

2. Fill Area: For each layer, perform one test every 750 square feet (perform a minimum of 3 tests).

3. Bottom of Wall Footings: Perform one test every 75 linear feet (perform a minimum of 3 tests).

4. Backfill Within Foundation Walls: For each layer, perform one test every 750 square feet.

5. Column Footings: Perform one test for every two footings.

6. Roadways and Under Pavement: Perform at least one test per layer for each 100 lineal feet of roadway.

D. Retest compaction tests that fail to pass after additional compaction effort has been performed and until the specified minimum compaction density is achieved. Two additional tests shall be taken for each failed test.

END OF SECTION
SECTION 02317
TRENCHING, BEDDING AND BACKFILL FOR PIPE

PART 1 - GENERAL

1.01 SECTION INCLUDES

Excavation, grading, bedding and backfill for underground piping systems as shown on the Drawings and specified in this Section.

1.02 REFERENCES

A. ANSI/ASTM Standards
   1. ANSI/ASTM C33 Concrete Aggregates
   2. ANSI/ASTM D698 (AASHTO T-99) Moisture-Density Relations of Soils and Soil Aggregate Mixture Using 5.5 lb. (2.49 kg) Rammer and 12 inch (305mm) Drop
   3. ANSI/ASTM D1557 (AASHTO T-180) Moisture-Density Relations of Soils and Soil Aggregate Mixture Using 10 lb. (4.54 kg) Rammer and 18 inch (457 mm) Drop

B. ASTM Standards
   1. ASTM D2487 Classification of Soils for Engineering Purposes
   2. ASTM D2922 (AASHTO T-238) Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Method (Shallow Depth)

C. AWWA Standards
   AWWA C600 Installation of Gray and Ductile Cast Iron Water Mains and Appurtenances

D. State of Florida
   Florida Trench Safety Act (90-96, Laws of Florida)

E. Occupational Safety and Health Administration
   Excavation Safety Standards, 29 CFR.1926.650, Subpart P.


1.03 MATERIALS TESTING

Utilize the services of a materials testing laboratory as specified in Section 01430 – Materials Testing.
1.04 ROCK

Rock excavation is anticipated and shall not be considered as classified. No additional Contract Time or Cost will be allowed for rock excavation.

PART 2 - PRODUCTS

2.01 GENERAL

A. Soil classifications presented in this Specification are applicable to natural and blended soils.

B. Soil classes and types referenced in this Specification are as defined in ASTM D2487.

2.02 SOURCE FOR BEDDING AND FILL MATERIALS

A. Use excavated materials that meet the requirements specified in this Section.

B. Furnish and install imported material if excavated material does meet the requirements of this Section, or if the quantity of suitable excavated material is not sufficient.

C. Excess excavated material that meets the requirements of this Section shall be stored at the project site until backfilling is completed. Do not remove from the project site excess excavated material that meets the requirements of this Section until backfilling is completed.

2.03 BEDDING MATERIALS

A. Crushed Stone Bedding: Imported, graded stone meeting the requirements of Class I with maximum particle size equal to one-half inch (1/2").

1. Size range and resulting high void ratio of crushed stone bedding material makes it suitable for use to dewater trenches during pipe installation.

2. The permeable characteristic of crushed stone dictates that use of crushed stone bedding material be limited to locations where pipe support will not be lost by migration of fine grained natural material from trench walls and bottom or migration of other embedment materials into crushed stone bedding material.

3. When migration of fine grained natural material into crushed stone bedding is possible;
   a. Crushed stone bedding shall be reduced to finer than one-quarter inch (1/4") minimum, and gradation shall be selected to limit the size of the voids, or;
   b. An alternative to modifying the gradation is to use a geotextile fabric as a barrier to migration to fines.
B. Coarse Sand and Gravel Bedding: Coarse sands and gravels meeting the requirements of Class II with maximum particle size equal to three-quarter inch (3/4") and with less than five percent fines.

1. Coarse-grained soils with less than 12 percent but more than five percent fines may be used for coarse sand and gravel bedding if approved by the Engineer.

2. Gradation other than well graded, such as uniformly graded or gap graded, may permit loss of support by migration into void spaces of a finer grained natural material from the trench wall and bottom.

   a) When migration of fine grained natural material into coarse sand and gravel bedding is possible, adjust gradation of bedding material to limit size of voids so there is no migration of fines from trench walls or trench bottom into bedding material.

   b) An alternative to modifying the gradation is to use a geotextile fabric as a barrier to migration of fines.

2.04 HAUNCHING MATERIALS

A. Haunching material shall be on-site or imported non-cohesive, non-plastic material free of debris and gravel larger than one-half inch in diameter.

B. Haunching materials shall be Class I or Class II soils as defined in ASTM D2487.

2.05 SELECT FILL MATERIALS

A. Select fill shall be on-site or imported non-cohesive, non-plastic material free of debris and gravel larger than one-half inch in diameter.

B. Select initial and final fill materials shall be Class I or Class II soils as defined in ASTM D2487.

2.06 COMMON FILL

A. Common fill shall be on-site or imported non-cohesive, non-plastic material, free of debris and rocks larger than two inches in diameter.

B. Common initial fill materials shall be Class I, Class II, or Class III soils as defined in ASTM D2487.

C. Common final fill materials shall be Class I, Class II, Class III or acceptable dry, native Class IV soils as defined in ASTM D2487.

PART 3 - EXECUTION

3.01 INSPECTION OF SOURCE FOR BEDDING AND FILL MATERIALS

Verify approval of full or limited use of stockpiled fill.
3.02 PREPARATION

A. Identify required lines, levels, contours, and datum.

B. Prior to trenching, cut or score pavement to straight edges, six inches outside each edge of the proposed trench. Do not damage pavement not removed.

C. Prior to trenching, clear and grub surface six inches outside each edge of the proposed trench. Stockpile material to be used as topsoil.

3.03 EXCAVATION

A. General

1. Dewater trenches, if necessary, as specified in Section 02240 - Dewatering.

2. Excavate trench so that piping can be installed to alignment and depth shown on the Drawings and as specified.

3. Trench width shall be ample to permit piping to be laid and jointed properly. Trench width shall be as shown on the Drawings and the Standards Details.

4. Grade top perimeter of trench to prevent surface water run-off into trench.

5. Open no more than 100 feet of trench ahead of pipe laying operations at one time unless a greater length of trench is approved by the Engineer.

B. Protection and safety

1. Protect existing facilities in accordance with Section 01150 - Protection of Existing Facilities.

2. Protect excavations by shoring, bracing, sheet piling, underpinning or other methods required to prevent cave-in or loose soil form falling into the excavation. Excavations slopes, shoring, bracing, sheet piling, underpinning or other methods shall conform with the Florida Trench Safety Act and 29 CFR 1926.50, Subpart P. If sheeting is used, sheeting may be removed provided removal can be accomplished without disturbing bedding, pipe or alignment. Should Engineer determine that removal of sheeting will damage pipe, the sheeting shall be left in place at no additional cost to the Owner. If left in place, cut sheeting off two feet (2') above top of pipe and leave sheeting in place below cut. Any damage to pipe bedding, pipe, or alignment caused by removal of sheeting shall be cause for rejection of the affected portion of the Work.

3. If sheeting is used, Contractor submit calculations and drawings prepared and sealed by a Florida P.E. to the Engineer for approval prior to commencement of sheeting operations.

4. Provide barricades, warning signs, and lights as required by law or regulation.

5. Underpin adjacent structures and utilities, including utility services, which may be damaged by excavation work.
6. Notify Engineer of unexpected subsurface conditions and discontinue work in affected area until notified by Engineer to resume work. Take emergency measures as required to protect persons and improvements.

C. Repair

Repair damage to existing facilities as specified in Section 01160 - Alteration of Existing Facilities.

3.04 TRENCH BOTTOM

A. Excavate trench to elevation required for pipe material.

1. For piping that does not require bedding below bottom of pipe, excavate trench to bottom of pipe.

2. For piping that requires bedding below bottom of pipe, excavate trench to bottom of bedding below pipe.

B. Soil surface at trench bottom shall provide a firm, stable and uniform support for pipe, and shall be free of any protrusions which may cause point loading on any portion of pipe or bell.

C. Do not over-excavate trench bottom if trench bottom material is stable undisturbed soil of the following types:

1. Class II soil including types GW, GP, SW and SP.

2. Class III soil including types GM, GC, SM and SC.

3. Class IV soil including types CL and ML.

D. Do not bed pipe on solid rock, boulders, hardpan, unsuitable soils, organic material, or other materials that are not suitable for trench bottom. Remove soils and other materials that are not suitable materials for trench bottom. Remove soils and other materials that are not suitable materials for trench bottom to six inches under pipe, minimum.

1. Remove wet, yielding, or mucky soils. Remove the following soils:
   a. Type CH and Type MH Class IV soils.
   b. All Class V soils.

2. Remove organic material including roots, mulch, or other vegetable matter, which in the opinion of the Engineer, will result in unsatisfactory foundation conditions.

3. Remove soils containing cobbles, boulders or stones larger than one and one-half inches (1-1/2") in diameter.

4. Remove ledge rock and hardpan. Remove rock and hardpan to provide bedding width 24 inches wider than pipe.

5. Remove soils containing rubbish, trash, or other foreign materials.
E. Replace ledge rock, hard pan, boulders, unsuitable soils, and soil containing material that is not suitable for trench bottom.

1. Over-excavation Replacement for Piping that Does Not Require Bedding below Bottom of Pipe.
   a. If trench is over-excavated more than six inches below the bottom of the pipe, but less than twelve inches below the bottom of the pipe, fill and compact over-excavation with acceptable Class I, II or III soil as defined in ASTM D2487.
   b. If trench is over-excavated more than twelve inches below bottom of pipe, fill and compact over-excavation with crushed stone bedding.

2. Over-excavation Replacement for Piping that Requires Bedding below Bottom of Pipe:
   Fill and compact over-excavation to bottom of bedding with Class I soil as defined in ASTM D2487.

3.05 BEDDING

A. General: Properly bed pipelines, conduits and appurtenances as shown on Drawings and as specified in this Section.

B. Bedding for all PVC Pipe: Place and compact crushed stone bedding from a minimum of 1/4 diameter of pipe below invert of pipe or 4” thickness, whichever is greater.

C. Bedding for Ductile Iron Pipe:
   1. If trench bottom at bottom of pipe is Class I, Class II, Class III or acceptable dry, native Class IV soils as defined in this Section, bed pipe on trench bottom.
   2. If trench bottom is not acceptable for bedding, place crushed stone bedding or coarse sand and gravel bedding from a minimum of 1/4 diameter of pipe below invert of pipe up to bottom of pipe or 4” thickness, whichever is greater.

D. Preparation of Trench Bottom for Piping and Conditions that Do Not Require Bedding below Bottom of Pipe.
   1. Compact trench bottom as required to achieve density specified for bedding, haunching, and backfill. Minimum compaction for trench bottom shall be 95% of maximum density as determined by ASTM D698 (AASHTO T-99, Method C).
   2. Bring trench bottom to grade prior to installation of pipe, fittings, and valves. Bring trench bottom to grade along entire length of pipe.

E. Preparation of Trench Bottom for Piping or Conditions that Require Bedding below Bottom of Pipe.
   1. Excavate trench bottom and place bedding material, so that bedding grade is correct following compaction of bedding.
2. Uniformly compact bedding. Use hand or mechanical tamping to compact bedding material.

3. Compact bedding material as required to achieve density specified for haunching and backfill. Minimum compaction of bedding material shall be 95% of maximum density as determined by ASTM D698 (AASHTO T-99, Method C).

4. Bring bedding material to grade prior to installation of pipe, fittings, and valves. Bring bedding material to grade along entire length of pipe.

3.06 HAUNCHING

A. Haunching for PVC Pipe: Place crushed stone bedding material from top of bedding to spring line (centerline) of pipe.

B. Haunching for Ductile Iron Pipe:

1. If trench bottom at bottom of pipe is Class I, Class II, Class III or acceptable dry, native Class IV soils as defined in ASTM D2487, place haunching material from trench bottom to spring line (centerline) of pipe.

2. If bedding is used under the pipe, place crushed stone bedding or coarse sand and gravel bedding material from top of bedding up to 1/8 diameter of pipe. Place haunching material from top of crushed stone bedding or coarse sand bedding material to spring line (centerline) of pipe.

C. Support piping during placement and compaction of haunching.

D. Placing Haunching Material

1. Do not place haunching over porous, wet, or spongy trench bottom or bedding material.

2. Hand place haunching material evenly along both sides of pipe, fittings, and valves so that equal load is maintained along both sides of pipe, fittings, and valves.

3. Work haunching under pipe, fittings, and valves so that there are no voids in fill and so that pipe, fittings, and valves are properly supported.

4. Place haunching so that piping materials, coatings, and encasement are not damaged.

E. Haunching Material Compaction

1. Compact haunching material haunching so that pipe, fittings, and valves are properly supported and to achieve density specified for backfill material.

2. Minimum compaction of haunching shall be 95% of maximum density as determined by ASTM D698 (AASHTO T-99, Method C).

3.07 INITIAL BACKFILL – COMMON and SELECT
A. Initial backfill shall extend from the top of haunching to one foot above top of pipe. Placement of initial backfill may be either by hand or mechanical means.

B. Initial fill in trenches wholly or partially beneath paved and other areas as follows shall be select fill:
   1. Public streets, roads, and parking areas.
   2. Institutional roads, drives, and parking areas.
   3. Commercial roads, drives, and parking areas.
   4. Under structures.

C. Initial fill in trenches beneath unimproved areas, lawns, landscaping, private drives, and private parking areas shall be common fill unless otherwise shown on the Drawings.

D. Keep initial backfill free from debris, rocks, clods, and other items larger than one-half inch (1/2”).

E. Do not compact initial fill directly over pipe, fittings, or valves until adequate cover has been provided to prevent damage to pipe, fitting, or valve. Adequate cover will depend on piping materials and type of compaction equipment used. Adequate cover shall be as accepted by the Engineer.

F. Minimum compaction of initial common fill shall be 95% of maximum density as determined by ASTM D698 (AASHTO T-99, Method C). Minimum compaction of initial select fill shall be 98% of maximum density.

3.08 FINAL BACKFILL

A. Backfill trenches to contours and elevations shown on drawings, or to match existing grade if finish grade is not changed.

B. Final backfill in trenches wholly or partially beneath paved areas as follows shall be select fill:
   1. Public streets, roads, and parking areas.
   2. Institutional roads, drives, and parking areas.
   3. Commercial roads, drives, and parking areas.

C. Final backfill in trenches beneath unimproved areas, lawns, landscaping, private drives, and private parking areas shall be common fill unless otherwise shown on the Drawings.

D. Backfill trench systematically, as early as possible, to allow maximum time for natural settlement.

E. Place and compact select fill material in continuous layers not exceeding 6 inches in depth. Minimum compaction of select fill shall be 98% of maximum density as determined by ASTM D698 (AASHTO T-99, Method C). Compaction
of select fill shall be by small portable plate compactor or other approved method.

F. Place and compact common fill material in continuous layers not exceeding 12 inches in depth. Minimum compaction of common fill shall be 95% of maximum density as determined by ASTM D698 (AASHTO T-99, Method C). Compaction of common fill shall be by mechanical means or other approved methods.

3.09 COMPACTION

A. Moisture Content

1. Compact materials at moisture content within +/-2% of the optimum to permit specified compaction.
2. Add water or permit material to dry until optimum moisture content is obtained.

B. Testing

1. Field test density of each compacted lift of initial backfill and select final backfill in accordance with ASTM D2922 prior to placement of succeeding lifts.
2. Make at least one test per lift for each 100 foot length of trench for initial backfill and final backfill.
3. If less than the prescribed amount of backfill is placed and compacted in a day, make one test per lift for each day’s length.

C. Additional Field Density Tests

1. If test density of compacted backfill or fill is less than specified density, make additional tests at locations directed by Engineer.

D. Proctor

1. Make one Proctor Test in accordance with ASTM D698 (AASHTO T-99) for each source of fill. If material from excavation is used as backfill material, take a test proctor from the best available location as determined by the testing lab.
2. Upon completion of backfill, take an additional proctor from actual material used and compare to test proctor. If actual proctor varies from test proctor, retest backfill.

END OF SECTION
SECTION 02503
CLEANING AND FLUSHING OF PIPING SYSTEMS

PART 1 - GENERAL

1.01 SECTION INCLUDES
Requirements for cleaning and flushing of piping systems.

1.02 REFERENCES
B. AWWA Standard for Disinfecting Water Mains (ANSI/AWWA C651-99).

1.03 SUBMITTALS
A. General: As specified in Section 01330-Submittals.
B. Submit copy of permit for flushing water disposal prior to flushing pipeline.
C. Submit flushing and cleaning water supply meter calibration record to Engineer.

1.04 REGULATORY REQUIREMENTS
A. Apply for permit from South Florida Water Management District prior to starting installation of pressure piping system. Apply, pay fees, and make all other arrangements for disposal of discharge from flushing.
B. Comply with permit requirements for flushing water disposal. Meet regulatory requirements relative to disposal of discharge water from flushing.

PART 2 - PRODUCTS (not used)

PART 3 - EXECUTION

3.01 PREPARATION
A. Furnish and install taps, connections, pipe, fittings, valves, pumps, and tanks required to flush and clean piping. Taps, connections, pipe, fittings, valves, pumps, and tanks shall be of proper size to provide flushing velocity specified in this Section.
B. For piping cleaned by pigging, furnish and install connections, pipe, fittings, and valves for launching and catching pig.
C. Provide backflow preventer, approved by the regulatory authority having jurisdiction, to connection between flushing water connection and potable water system.

D. Furnish and install meter to record volume of water used for flushing and cleaning. Use meter approved by the Engineer. An independent laboratory, or other facility acceptable to the Engineer, shall have calibrated the meter within one year prior to the installation date for flushing and cleaning.

3.02 FLUSHING AND CLEANING INTERIOR OF PIPING

A. General

1. Flush and clean interior of piping.
2. Flush potable water piping with potable water.
3. Flush all other piping with potable water or reclaimed water.
4. Coordinate flushing time and duration with Owner. The Owner shall be present at all times during flushing.
5. The Owner does not guarantee that the specified minimum flushing rates can be obtained from existing pressure piping systems. Contractor shall provide water, pumps, tanks, and piping required to produce specified flushing velocity at no additional cost to the Owner.

B. Flushing

1. For pipe sizes less than 12”, full-bore flushing is required with a minimum flushing velocity of 4 feet per second.
2. For pipe sizes 12” and greater, pigging is required for flushing. Follow manufacturers recommendations for operation of pig. Run water until clear after recovery of pig.

3.03 DISPOSAL OF FLUSHING WATER

A. Discharge flushing water to storm drain systems in accordance with the permit for disposal of flushing water and as specified in this Section. Provide silting basins and other discharge treatment systems in accordance with permit for flushing water disposal and to meet discharge permit requirements.

B. Dispose the flushing water without causing a nuisance or property damage.

C. Do not allow discharge from flushing to puddle or pond on construction site except in areas designated and approved to receive flushing water.

D. Do not allow discharge from flushing to flow off construction site except through permitted discharge structures and through pipes, conduits, and channels designated and approved for discharge flow from flushing.

E. Do not use sanitary sewers for disposal of flushing water.

F. Do not discharge flushing water containing settleable solids into storm sewers.

G. Do not contaminate or disturb the environment of properties adjacent to the Work.
H. Do not contaminate streams or other surface waters.

I. Provide temporary facilities and controls for flushing water discharge. Temporary facilities and controls shall be appropriate to the project, including, but not limited to:
   1. Silting basin, or basins, of adequate size.
   2. Filters.
   3. Coagulants.
   4. Screens.

J. Discharge onto pavement shall not damage pavement.

3.04 CONNECTION OF NEW PRESSURE PIPING SYSTEM TO EXISTING PRESSURE PIPING SYSTEM

A. Do not complete connection of new potable water piping system to existing potable water piping system until Engineer has approved connection of new potable water piping system to existing potable water piping system.

B. Do not complete connection of new potable water pressure piping system or pressure wastewater system to existing piping system until flushing, cleaning, and pressure testing of new piping system is complete.

C. Do not complete connection of potable water piping until bacteriological clearance has been received. Refer to Section 02505-Pressure Testing of Piping Systems, and Section 02507-Disinfection of Potable Water Piping.

3.05 REMOVAL OF TEMPORARY FLUSHING AND CLEANING SYSTEM

A. Remove temporary pipe, fittings, valves, pumps, and tanks installed for flushing and cleaning. Furnish and install caps on plain ends of pipe, plugs in joints bells, and blind flanges on flanges after temporary piping is removed.

B. If shut-down of Owner’s piping system, or systems, is required to remove temporary piping, shut-down shall only be done by Owner. Notify Owner of requested shut-down not less than 48 hours in advance of requested shut-down. Coordinate removal of temporary piping with Owner’s shut-down schedule.

END OF SECTION
SECTION 02505
PRESSURE TESTING OF PIPING SYSTEMS

PART 1 - GENERAL

1.01 SECTION INCLUDES

Requirements for pressure testing of liquid piping systems.

1.02 REFERENCES

A. General: As specified in Section 01090 - Reference Standards.

B. ANSI/AWWA Standards

1. ANSI/AWWA C600 Installation of Ductile-Iron Water Mains and Their Appurtenances.

2. ANSI/AWWA C605 Underground Installation of Polyvinyl Chloride (PVC) Pressure Pipe and Fittings for Water.


1.04 SUBMITTALS

A. General: As specified in Section 01330-Submittals.

B. Submit pressure recording charts for hydrostatic test to Engineer not more than three (3) days following pressure test.

1.05 NOTIFICATION

A. Notify Engineer at least 48 hours in advance of start of pressure test.

B. If the Engineer states that the Engineer will observe pressure test, do not start pressure test unless the Engineer is present. If the presence of the Engineer is required and testing is not observed by the Engineer, testing shall be repeated with the Engineer present at no additional cost to the Owner.

C. If the Engineer states that the Owner will observe pressure test, do not start pressure test unless the Owner is present. If the presence of the Owner is required and testing is not observed by the Owner, testing shall be repeated with the Owner present at no additional cost to the Owner.

PART 2 – PRODUCTS

2.01 TEST EQUIPMENT, PIPING, WATER STORAGE VESSELS, AND APPURTENANCES
Contractor shall be responsible for the selection of pressure test equipment, piping, water storage vessels, and appurtenances.

PART 3 – EXECUTION

3.01 PRESSURE TEST - GENERAL

Perform test on completed piping sections. Testing shall not proceed until concrete thrust blocks are in place and cured, or other restraining devices are installed.

3.02 PREPARATION FOR TEST

A. All piping shall be thoroughly cleaned and flushed prior to testing to clear the lines of all foreign matter.

B. Furnish and install taps and connections required to perform pressure test

C. Taps shall be of adequate size to fill and pressurize piping section to be tested.

D. If lower end of piping section to be tested is closed, provide tap at lower end of piping.

E. Tap piping at high points in piping section to be tested to release air from piping.

F. Expel air from piping prior to application of test pressure.

3.03 PREPARATION FOR TEST - OPEN-END PIPING SYSTEMS

A. Securely install test plugs in or test caps on open ends of piping section to be tested so they remain on the pipe with test pressure applied.

B. Provide tap in each test plug and test cap.

C. Test plugs and test caps shall be capable of holding 1.5 times the test pressure applied to the piping section to be tested.

3.04 FILLING LINE TO BE TESTED

A. Place water into line at lower end of line.

B. Expel air from line.

3.05 HYDROSTATIC TEST

A. Test Pressure:

1. Potable Water Mains and Piping: 150 psi.

2. All Wastewater Piping: 150 psi.

3. All Reuse Water Piping: 150 psi
B. Test Period: Not less than two consecutive hours.

A. For ductile iron pipe, the allowable rate of leakage shall be less than the number of gallons per hour determined by the following formula:

\[ L = \frac{(SD(P)^{1/2})}{133,200} \]

Where

- \( L \) = Allowable leakage in gallons per hour;
- \( S \) = Length of pipe tested in feet;
- \( D \) = Nominal diameter of the pipe in inches;
- \( P \) = Average test pressure maintained during the leakage test in pounds per square inch;

For pressure of 150 psi, \( L = 9.195 \times 10^{-5} \ SD \)

D. For polyvinyl chloride (PVC) pipe, the allowable rate of leakage shall be less than the number of gallons per hour determined by the following formula:

\[ L = \frac{(ND(P)^{1/5})}{7,400} \]

Where

- \( L \) = Allowable leakage in gallons per hour;
- \( N \) = Number of joints in the length of pipeline tested;
- \( D \) = Nominal diameter of the pipe in inches;
- \( P \) = Average test pressure during the leakage test, in pounds per square inch;

For pressure of 150 psi, \( L = 1.66 \times 10^{-3} \ ND \)

E. Pressure and Leakage Recording - Record test pressure and leakage with a recording pressure gauge. Submit record to Engineer.

3.06 VISUAL EXAMINATION

A. Visually examine exposed pipes, fittings, valves, hydrants, and joints during pressure test.

B. Visually examine ground surface and filled trenches along route of piping for visible leakage and indications of leakage.

3.07 SYSTEM REPAIR

A. Repair all visible leaks regardless of pressure test results.
B. If piping system fails pressure test, locate and repair leaks. Replace defective pipe, fittings, valves, and other products at no additional cost to the Owner.

C. Repeat pressure testing and piping system repair until piping system meets the requirements of this Section.

3.08 TEST CLEAN-UP

A. Remove testing equipment, piping, water storage vessels, and appurtenances.

B. Remove test plugs and test caps after test is successfully completed.

C. Plug taps water-tight after test is successfully completed.

END OF SECTION
SECTION 02507
DISINFECTION OF POTABLE WATER PIPING

PART 1 - GENERAL

1.01 SECTION INCLUDES

Requirements for disinfection and bacteriological testing of potable water piping.

1.02 REFERENCES

A. General: As specified in Section 01090 - Reference Standards
B. AWWA Standards
   AWWA C651 Disinfecting Water Mains

1.03 SUBMITTALS

A. General: As specified in Section 01330-Submit	tals
B. Submit copy of permit for flushing water disposal to Engineer prior to flushing the pipeline.
C. Submit copy of bacteriological test report to Engineer as specified in this Section

1.04 REGULATORY REQUIREMENTS

A. Bacteriological Clearance: Contractor shall not put new potable water piping in service prior to receipt of bacteriological clearance from regulatory authority having jurisdiction.

B. Flushing Water Disposal

1. Apply for permit from South Florida Water Management District prior to starting installation of pressure piping system. Apply, pay fees, and make all other arrangements for disposal of discharge from flushing.
2. Prior to flushing the pipeline, submit a copy of the permit for flushing water disposal to the Engineer.
3. Comply with permit requirements for flushing water disposal. Meet regulatory requirements relative to disposal of discharge water from flushing.

PART 2 - PRODUCTS

2.01 DISINFECTION SYSTEM

Contractor shall be responsible for the sizing and selection of disinfection system, disinfection equipment, disinfection system piping, laboratory testing and appurtenances.
PART 3 - EXECUTION

3.01 DISINFECTION SEQUENCE

A. Prior to disinfection, the Contractor shall install potable water pipe, fittings, valves, and appurtenances; complete any required repairs; and clean, flush, and pressure test the potable water piping system.

B. Disinfect and flush potable water piping as specified in this Section.

C. Following flushing of chlorine solution, collect samples and perform bacteriological testing as specified in this Section.

D. Install and disinfect piping for dry connections.

E. Disconnect and remove equipment, piping, and appurtenances after water mains are successfully disinfected, bacteriological testing is complete, and water mains are approved for connection to the existing water distribution system.

3.02 PREPARATION

A. Obtain approval from the Engineer prior to starting disinfection of potable water piping system.

B. Furnish and install taps and connections required to inject chlorine solution into potable water piping system.

3.03 BACTERIALLOGICAL SAMPLE POINTS

A. Provide and install bacteriological sample points as shown on the Drawings.

B. Bacteriological sample points shall be at the following locations:
   1. Test Sections 1,000 Feet and Smaller: One sample for each pipe section, tested at the farthest point from chlorine injection.
   2. Test Sections Greater Than 1,000 Feet: One sample for every 1,000 feet of line, tested at regular intervals along water pipe sections.
   3. Dead Ends: One sample at each dead end.
   4. Other Locations: As shown on the Drawings.

C. Appropriately located fire hydrants may be utilized for sampling points. Under this circumstance, the Contractor will be solely responsible for maintaining the hydrants in a satisfactory environment for conducting the bacterial testing.

D. Utilities personnel will use bacteriological sample points for water main bacterial clearance procedures.

3.04 DISINFECTANT

A. Disinfect potable water piping with chlorine.

B. Chlorinating agent shall be selected by the Contractor and accepted by the Engineer.
C. Acceptable chlorinating agents include the following:
   2. Calcium hypochlorite
   3. Sodium hypochlorite

D. Select the chlorinating agent appropriate to the size and length of piping to be disinfected and to the location of piping system. Do not use chlorine gas in residential, commercial, or institutional areas.

E. Placing chlorine tablets or powder in the piping is not an acceptable method of disinfection.

F. Provide equipment and feed system for chlorinating agent that is appropriate to the chlorinating agent and the piping to be disinfected.

G. If disinfection cannot be achieved with the furnished and installed system, modify or replace the disinfection system until disinfection of potable water piping can meet the requirements of this Section.

3.05 DISINFECTION OF POTABLE WATER PIPING

A. Fill potable water piping with water containing 50 to 100 parts per million available chlorine. Quantity of disinfectant required for 100 feet of pipe is presented in tables at end of this Section. Tables are to be used only as a guide and are not guaranteed.

B. Perform disinfection using the following schedule unless otherwise approved by the Engineer:
   1. Friday: Inject chlorine solution;
   2. Saturday and Sunday: Allow chlorine to remain in piping system.
   4. Tuesday and Wednesday: Collect bacteriological samples.

C. Feed chlorinating agent at or near the point from which potable water piping is to be filled. Control flow and proportioning of water and chlorinating agent so that specified chlorine concentration is achieved throughout piping to be disinfected. Eliminate air pockets as piping is filled.

D. Allow chlorine solution to stand in piping for not less than 48 hours.

E. Operate valves and other appurtenances during disinfection to assure sterilizing mixture is dispersed into all parts of system being disinfected.

F. Check chlorine residual at sample points after chlorine solution has remained in piping for 48 hours or longer. Disinfection and chlorine residuals shall conform to AWWA C600 and C601.

3.06 DISPOSAL OF CHLORINE SOLUTION
A. After chlorine solution has been retained for the required time, flush and fill pipes with potable water from the distribution system in service.

B. Discharge water from flushing to storm drain systems in accordance with permit for disposal of flushing water and as specified in this Section.

C. Reduce chlorine concentration to a level that will not harm plants or animals in ditches, streams, canals, ponds, lakes, waterways, bays, estuaries, or any other location that could be impacted by disinfectant discharge. Provide temporary dechlorination tanks, equipment, and chemicals as required to reduce the chlorine concentration to a level that will not harm plants or animals. The chlorine concentration in the discharge to a storm drain system shall not exceed 0.1 parts per million.

3.07 BACTERIOLOGICAL SAMPLING AND TESTING

A. The Contractor shall have a qualified testing laboratory technician take water samples for bacteriological examination after receiving adequate notice, 48 hours minimum, from the Contractor.

B. The Contractor shall pay for all bacteriological tests.

C. Bacteriological test shall meet the requirements of AWWA C651.

D. Bacteriological Test Reports: Include the following in each bacteriological test report:

   1. Date issued;
   2. Project name;
   3. Testing laboratory name, address, and telephone number;
   4. Time and date of water sample collection;
   5. Name of person collecting sample;
   6. Test location, or locations;
   7. Initial and 24 hour disinfectant residuals in mg/L for each sample point.
   8. Coliform bacteria test results for each sample point.
   9. Certification that water conforms, or fails to conform to bacteriological standards of the State of Florida;

3.08 PLACING POTABLE WATER PIPING IN SERVICE

A. Do not place potable water piping in service until the Engineer has approved placing potable water piping in service.

B. Do not place potable water piping in service until disinfection of potable water piping has been completed and bacteriological clearance for potable water piping has been received.
Appropriate Quantity of Calcium Hypochlorite Solution (70% Available Chlorine) Required to Produce 50 mg/l of Available Chlorine per 100 feet of Pipe

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<th>Pipe Size</th>
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<th>Ounces per 100 Feet</th>
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## Approximate Quantity of Sodium Hypochlorite Solution (5.25% to 14.7% Available Chlorine)
Required to Produce 50 mg/l of Available Chlorine per 100 feet of Pipe

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**END OF SECTION**
SECTION 02630

STORM SEWERS AND STRUCTURES

PART 1 - GENERAL

1.01 SECTION INCLUDES
All materials and methods to construct or repair and place into operation a storm sewer system as shown on the Drawings and as directed in the field.

1.02 REFERENCES
ASTM C-76 – Standard – Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe
ASTM C-270 – Standard – Specification for Mortar for Unit Masonry
ASTM C-150 – Standard Specification for Portland Cement
ASTM C-144 – Standard Specification for Aggregate for Masonry Mortar
ASTM C-91 – Standard Specification for Masonry Cement
ASTM A-615 – Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
ASTM D-2729 – Standard Specification for Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings
FDOT Standard Specifications Sections
  400 Concrete Structures
  415 Reinforcing Steel
  425 Inlets, Manholes, and Junction Boxes
  430 Pipe Culverts and Storm Sewers [See 2.01 in this Section]
  941 Concrete Pipe (For Culvert and Underdrains) [See 2.01 in this Section]
  942 Pipe Gaskets
  943 Corrugated Steel Pipe and Pipe Arch (Including Underdrain)
  945 Aluminum Pipe, Including Underdrain, Pipe Arch and Structural Plate Pipe and Pipe Arch
Collier County DOT Standards and Utilities Standards Manual, latest editions with revision.

1.03 SUBMITTALS
A. General: As specified in Section 01330 – Submittals.
B. Submit written results of inspection as noted in Part 3 of this Section.
PART 2 - PRODUCTS

2.01 REINFORCED CONCRETE PIPE
A. Reinforced Concrete Pipe shall be ASTM C-76, Class III with Wall Type B reinforcement; inside nominal diameter as shown on Drawings; bell and spigot end joints. Pipe joints shall be rubber gasket joints conforming to Sections 941 and 942 of FDOT Standard Specifications. The use of lifting holes in pipe 30” in diameter and less shall not be allowed. Fiber reinforced pipe shall not be allowed.

2.02 METAL PIPE
A. Bituminous-coated corrugated metal pipe shall meet the requirements of Section 943 or Section 945 of FDOT Standard Specifications.

2.03 PVC PIPE
A. Perforated polyvinyl chloride (PVC) pipe shall conform to ASTM D-2729.

2.04 MORTAR
Mortar used for constructing and plastering manholes, drop inlets and junction boxes: In accordance with ASTM Specifications Serial Designation C-270. Contractor has the option of using either a portland cement/hydrated lime mixture or a portland cement mixture with masonry cement added for improved workability; however, the Contractor shall use the same materials throughout the project. Mortar materials shall be proportioned by volume as follows:

A. One (1) part Type I Portland Cement - ASTM C-150.
B. Three (3) parts Aggregate (sand) - ASTM C-144.
C. The addition of masonry cement (ASTM C-91) will be permitted to improve workability of mortar.

2.05 REINFORCING BARS
Reinforcing bars shall be deformed reinforcing steel conforming to Specifications for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement (ASTM A-615), for concrete reinforcement. All bars shall be lapped and placed in accordance with ACI requirements and specifications.

2.06 IRON CASTINGS
A. Casting shall conform to latest revision of the ASTM A-48 for Class 30 Gray Iron. They shall be cast in a closed mold with controlled sand and be true to pattern. Casting shall be free from blow holes and porosity, well cleaned, with fine and sharp edges ground smooth. All circular frames and covers shall be machined (on lathe) bearing surfaces to prevent rattling under traffic. All manhole covers shall have "Storm Sewer" cast thereon and comply with County regulations and standards. All square and rectangular frames, covers and grates shall be individually fitted as sets and installed as sets in the field.
B. Manufacturer shall provide letter of guarantee for a period of 15 years. Upon request of Engineer, manufacturers shall also furnish an independent testing laboratory's report of castings supplied. Frame and cover surfaces shall be machined and any tendency to rattle, as determined by tests before or after installation, will be sufficient cause for rejection of the frame and cover.

2.07 STRUCTURES

A. Concrete for catch basins, storm sewer manholes and concrete headwalls shall develop a compressive strength of 4000 psi in 28 days.

B. All structures shall conform to Sections 400, 415, and 425 of FDOT Standard Specifications and to the details and dimensions shown on the Contract Drawings.

PART 3 – EXECUTION

3.01 HANDLING

A. Load and unload pipe and accessories by lifting with hoists or skidding in a manner that will avoid shock or damage. Under no circumstances shall such materials be dropped. Pipe handled on skidways shall not be skidded or rolled against pipe already on the ground.

B. In distributing material at the site of the work, unload each piece near where it shall be laid in the trench.

3.02 LAYING PIPE

A. Complete trenching and backfilling as specified. Inspect sewers when line is completed and backfill has been placed to a depth of one foot over the pipe. Complete backfill only after approval of each section has been given for line and grade.

B. Remove and relay faulty sections of line rejected by Engineer.

C. Exercise care to insure pipe is carefully centered so laid storm sewer will have a uniform invert.

D. Keep pipe joints clean at all times, and use no pipe in the work which does not conform to specifications.

E. At all times when pipe-laying operations are not in process (including lunch hours), place a watertight stopper in the end of the pipe last laid to prevent water, mud or other foreign materials from entering the pipe. Insure all construction conforms to Section 430 of FDOT Standard Specifications.

3.03 JOINING PIPE
A. Join all pipe by rubber gasket O-ring joints installed in strict accordance with recommendations of pipe manufacturer.

B. Corrugated metal pipe joints shall consist of bolted galvanized metal connecting band installed with neoprene gasket.

C. Joints shall be designed to limit movement due to expansion, contraction and normal settlement.

D. When using Elliptical Concrete Pipe, all joints are to have Ram Neck used as a gasket or equivalent, and all joints are to be wrapped per Section 430-7.3 of FDOT Standard Specifications.

3.04 CATCH BASINS, STORM SEWER MANHOLES AND CONCRETE HEADWALLS

A. Construct junction boxes, storm sewer manholes, and concrete headwall at location and depth indicated on drawings and in accordance with details shown hereon. Excavate and backfill in accordance with applicable sections of specifications. Seal joints between walls and incoming and outgoing pipes with portland cement mortar to form a watertight joint. Cut off all pipes in junction boxes, storm sewer manholes, and concrete headwalls flush with the face of the structure and grout broken ends of these pipes with portland cement mortar to a smooth uniform covering with no steel exposed.

B. Construct grated inlets and junction boxes to elevations and dimensions shown on the Drawings. Final adjustment of the gratings can be made while mortaring the frames in place. Secure grating frames in mortar struck smooth inside and out.

3.05 INSPECTION

A. The Contractor shall inspect all installed storm sewer pipes by ‘lamping’. Lamping is accomplished by placing a light at one end of the pipeline, and viewing the inside of the pipe from the other end.

B. The Contractor shall ensure that the pipeline is clean, straight, round and with no collapsed or indented sections.

C. The Engineer shall be present during all inspections to confirm the visual findings.

D. The Contractor shall replace sections not acceptable to the Engineer.

END OF SECTION
SECTION 02740
ASPHALTIC CONCRETE PAVEMENT

PART 1 - GENERAL

1.01 SECTION INCLUDES

Requirements for construction of new and replacement asphaltic concrete pavement and new limerock roadways (unpaved).

1.02 REFERENCES

A. "DOT Specifications" – Florida Department of Transportation Standard Specifications for Road and Bridge Construction.

B. Collier County DOT Standards, latest edition.


1.03 SYSTEM DESCRIPTION

A. Furnish and install asphaltic concrete pavement in accordance with the lines, grades and typical section as indicated on the Drawings and as described in Part 3 herein.

B. Furnish and install new asphaltic concrete pavement required to complete the paving work and as described in Part 3 herein.

C. Furnish and install asphaltic concrete topping as indicated on the Drawings and as described in Part 3 herein.

D. Repair asphaltic concrete pavement damaged as a result of completing Work and damaged by construction operations and as described in Part 3 herein.

E. Provide limerock roadways as shown on Contract Drawings.

1.04 SUBMITTALS

A. General: As specified in Section 01330 – Submittals

B. Submit the proposed formula for the asphaltic concrete paving prior to starting pavement work.

1.05 QUALITY CONTROL

A. DOT Specifications and Collier County Standards referred to in this Section are 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.

B. In the event of a conflict between the referenced standards or between the standards and other Contract provisions, the more stringent requirement shall apply.

PART 2 - PRODUCTS
2.01 MATERIALS

A. Limerock Base: Limerock base shall consist of either one or two courses of Miami Oolite limerock in accordance with Section 200 and 911 of the DOT Specifications.

B. Prime Coat: Material used for prime coat shall be cut-back Asphalt Grade RC-70 conforming to Sections 300 and 916 of the DOT Specifications for prime to be used on Miami Oolite formation limerock.

C. Tack Coat: Material used for tack coat shall be Emulsified Asphalt Grade RS-2 conforming to Sections 300 and 916 of the DOT Specifications. All areas to be paved shall receive a final tack coat that provides a uniform finish for new and existing paving.

D. Asphaltic Concrete: Materials and construction of asphaltic concrete patch and surface courses shall be Type S-III Asphaltic Concrete conforming to Sections 330, 331 and 916 of the DOT Specifications.

PART 3 - EXECUTION

3.01 GENERAL

A. Restoration Requirements

1. The extent and detail of roadway replacement shall be required by the Contract Documents, the Collier County DOT Standards, and the Collier County Utilities Standards Manual.

2. Replacement of asphalt roadway due to trenching shall include at least one lane. The roadbase replacement shall include the standard width of 3 feet plus the trench width. In addition, the asphalt must be removed and replaced for at least one full traffic lane. If the required extent of asphalt replacement extends into two or more lanes, the asphalt must be removed and replaced cross all lanes.

3.02 INSTALLATION

A. Subgrade

1. If subgrade is existing, such as for paving an existing road, make Limerock Bearing Ratio (LBR) measurements on each 3,000 square feet of subgrade. If subgrade has an LBR of at least 40, it may be used in-place. If it is less than 40, prepare the subgrade as described below.

2. Stabilize roadway subgrades to the minimum depth shown on the Drawings to an LBR of not less than 40. Stabilizing shall be Type B as defined in Section 160 of the DOT Specifications. Stabilization may require addition and thorough mixing in of crushed limerock, course limerock screenings, or any other stabilizing material acceptable to the Engineer. Apply stabilizing material in such quantity that, after mixing and blending, the subgrade will have a LBR of not less than 40. Mix or blend stabilizing material into subgrade material by plowing, scarifying, diskng, harrowing, blading or mixing with rotary tillers until mixed materials are of uniform bearing value throughout width and depth of layer being processed.

3. Make not less than three density determinations on each day's final compaction operations on each course. Make density determinations at more frequent intervals if deemed necessary by the Engineer.
B. Limerock Base

1. If limerock base is existing, such as for paving an existing limerock road, make thickness and density measurements on each 3,000 square feet of base. If the base meets the requirements of this specification, it may be used in-place. If it does not meet this specification, prepare the limerock base as described below.

2. Construct limerock base in accordance with Section 200 of the DOT Specifications, to the thickness and width indicated on the Drawings.

3. After spreading of the base material is completed, scarify entire surface and shape surface to produce the exact grade and cross section after compaction. For double course base, extend scarifying to a depth sufficient to penetrate slightly the surface of the first course. The maximum depth of each lift shall be 8 inches.

4. When the material does not have the proper moisture content to insure the required density, wetting or drying shall be required.
   a. If the material is deficient in moisture, add and uniformly mix in water by disking the base course to the full depth of the base course.
   b. If the material contains an excess of moisture, allow the material to dry to proper moisture content before compacting material.

5. As soon as proper conditions of moisture are attained, compact material to an average density not less than 98 percent maximum density. If there is more than one course, the density shall be obtained in each lift of the base.

6. During final compacting operations, if blading of any areas is necessary to obtain true grade and cross section, complete compacting operations for such areas prior to making density determination on finished base.

7. Unless otherwise directed by the Engineer, “hard-plane” the surface with a blade grader immediately prior to the application of the prime coat to remove the thin glaze or cemented surface and to allow free penetration of the prime material. Materials planed from the base shall be removed from base area.

8. If cracks or checks appear in the base, either before or after priming, which in the opinion of the Engineer, would impair the structural efficiency of the base course, remove such cracks or checks by rescarifying, reshaping, adding base material where necessary and recomping.

9. If at any time the subgrade material shall become mixed with the base course material, dig out and remove the mixture, reshape and compact the subgrade and replace the materials removed with clean base material. Shape and compact clean base material as specified in this Section.

C. Prime Coat: Apply prime coat at a rate of 0.15 gallons per square yard, and perform the Work in accordance with Section 300 of the DOT Specifications.

D. Tack Coat: Apply tack coat at a rate between 0.02 and 0.10 gallons per square yard, and perform the Work in accordance with Section 300 of the DOT Specifications.

E. Asphaltic Concrete: Spreading, compact, and joint the wearing surface in accordance with Sections 330 and 331 of the DOT Specifications to the thickness indicated on the Drawings.

END OF SECTION
SECTION 02765
CONCRETE PAVEMENT, CURB AND WALKWAYS

PART 1 - GENERAL

1.01 SECTION INCLUDES

Requirements for furnishing and installing concrete pavement, curbs and walkways.

1.02 REFERENCES

A. Collier County DOT Standards, latest edition.

1.03 SUBMITTALS

A. General: As specified in Section 01330 - Submittals
C. Submit the concrete mix designs, including content of wetting compound or sealers, reinforcing steel bar diagrams and information on the proposed joint materials to the Engineer for approval prior to starting construction of concrete pavement, curbs, and walkways.

1.04 QUALITY CONTROL

In the event of a conflict between the referenced standards or between the standards and the other Contract provisions, the more stringent requirement shall apply.

PART 2 - PRODUCTS

2.01 CONCRETE

A. Concrete shall conform to the requirements of Division 3 - Concrete.
B. Mix designs for the concrete shall be submitted to the Engineer for approval.

2.02 REINFORCING AND WELDED WIRE FABRIC

Joint reinforcing and welded wire fabric shall conform to the requirements of Division 3 - Concrete.

2.03 JOINT SEALER FOR PAVEMENT

A. Joint sealer shall be a two-part polysulfide base self-leveling sealant for horizontal surfaces that has been developed for foot and vehicular traffic.
B. Specifications for the sealant shall be submitted to the Engineer for approval.

2.04 PREFORMED JOINT FILLER
A. Preformed joint filler shall be sponge rubber and conform to the requirements of AASHTO Designated M148, Type 1.

B. Samples and specifications of the preformed joint filler shall be submitted to the Engineer for approval.

PART 3 - EXECUTION

3.01 SUBGRADE CONDITION

A. Subgrade shall be free of rocks, organic matter and other deleterious matter. Compact subgrade to provide a firm foundation for the concrete. Refer to Section 02316, Structural Earthwork.

B. Maintain finished subgrade in a smooth, compact condition, and restore any areas that are disturbed prior to placing of the concrete. Subgrade shall be moist when concrete is placed. Uniformly apply water ahead of the paving operations. If the subgrade is not maintained in the required moist condition, a vapor barrier sheet shall be required between the subgrade and the concrete.

C. Accurately trim subgrade to the required elevation with a 1/4-inch tolerance. Trim high areas to proper elevation. Low areas may be filled with suitable material and compacted to the specified density or filled with concrete integrally with the placing of the pavement.

3.02 SETTING FORMS

A. Forms shall be accurately set to line and grade and so that forms rest firmly upon the compacted subgrade surface throughout entire length of forms.

B. Forms shall be joined neatly and tightly and braced to resist pressure of wet concrete and finishing operations.

C. Alignment and grade of forms shall be approved immediately prior to the placing of concrete.

3.03 MIXING CONCRETE

Concrete shall be mixed as specified in Division 3 – Concrete and in accordance with the approved mix design.

3.04 PLACING CONCRETE

A. Distribute concrete on subgrade to such depth, that, when concrete is consolidated and finished, slab thickness shown on the Drawings will be obtained at all points and surface of concrete will at no point be below grade specified for finished surface, after application of the allowable tolerance. Deposit concrete on subgrade in a manner that will require as little rehandling of concrete as possible.

B. Place wire fabric or bar reinforcement at mid slab depth, and maintain reinforcement at mid slab depth during placing and finishing of concrete.

C. Thoroughly consolidate concrete against and along faces of forms, by means of hand-operated, spud-type vibrators. Do not allow vibrators to come in contact with the
subgrade or a side form. Do not continue vibration at any one location so long as to
produce puddling or accumulation of excessive grout on surface. In no case shall vibrator
be operated longer than 15 seconds in any one location.

3.05 STRIKING-OFF, CONSOLIDATING AND FINISHING CONCRETE

A. Immediately after placing concrete, strike-off, consolidate and finish concrete, to produce
finished pavement conforming to cross section, surface grade and width.

B. Surface finishing sequence shall be as follows:
   1. Strike-off;
   2. Vibratory consolidation;
   3. Screeding;
   4. Floating;
   5. Removal of laitance;
   6. Straight-edging;
   7. And final surface finish.

3.06 STRAIGHT-EDGING AND SURFACE CORRECTIONS

A. After floating has been completed and the excess water removed, but while the concrete
is still in a plastic state, test surface of concrete for trueness with an accurate 10-foot
straightedge. The straightedge shall be furnished by the Contractor.

B. Straightedge shall be held in successive positions parallel to the road, or drive, centerline,
in contact with the surface. Test whole area tested from one side of the slab to the other
as necessary.

C. Immediately fill any depressions with freshly mixed concrete and strike-off, consolidate
and refinish concrete. Cut down and refinish any high areas.

D. Continue straightedge testing and surface correction until entire surface appears to
conform to required grade and cross section.

3.07 FINAL FINISH

A. As soon as water sheen has disappeared from surface of the pavement and just before
concrete becomes nonplastic, give surface a light broom finish.

B. Pavement and walk finishes shall be uniform flat and within tolerances specified in
Division 3.

3.08 EDGING

A. After final finish has been applied, but before concrete has become nonplastic, carefully
round edges of pavement to 1/4 inch radius along each side of strip being placed, on
each side of construction joints and along any structure extending into pavement, unless
otherwise shown on the Drawings. Produce a well-defined and continuous radius and
obtain a smooth, dense mortar finish. Remove any concrete from the top of joint filler.
B. Check joints with a straightedge before concrete has become nonplastic. Make necessary corrections if one side of joint is higher then the other or the entire joint is higher or lower than adjacent slabs.

3.09 JOINTS

A. Construction Joints: Locate construction joints as shown on the Drawings.

B. Expansion Joints Around Structures

1. Form expansion joints by placing premolded expansion joint material along structures and features projecting through, into or against pavement.

2. Unless otherwise indicated, such joints shall be 1/2 inch in width.

C. Transverse Expansion Joints

1. Provide open type transverse expansion joints at sidewalk returns, at 30 feet intervals, and as indicated on the Drawings.

2. Form open type joints by staking a 1/4-inch thick metal bulkhead in place and placing concrete on both sides. After concrete has set sufficiently to preserve width and shape of joint, remove bulkhead. After the sidewalk has been finished over joint, open slot and edge with a tool having a 1/2-inch radius.

3. Clean transverse expansion joints and fill transverse expansion joints with joint filler strips 1/4 inch thick conforming to the requirements of AASHTO M-153.

D. Scored Joints: Scored joints shall be either formed or sawed at 5-foot intervals and shall extend to a depth of at least one fourth of the sidewalk slab thickness.

3.10 CURING

A. After the finishing operations have been completed and as soon as the concrete has hardened sufficiently that marring of the surface will not occur, cover entire surface and edges of newly placed concrete and cured concrete with membrane curing compound.

B. Uniformly apply curing compound to surfaces to be cured, in a single coat, continuous film, at rate of one gallon to not more than 200 square feet. Apply curing compound with a mechanical sprayer.

C. Do not apply curing compound during periods of rainfall. Do not apply curing compound to inside faces of joints to be sealed.

D. Should curing film become damaged from any cause within required curing period, immediately repair damaged portions with additional compound.

E. Upon removal of side forms immediately coat exposed sides of slabs to provide a curing treatment equal to that provided for the surface.

3.11 CURBS
A. Construct curbs in uniform sections ten feet in length except where shorter sections are necessary for closures or arcs. Separate sections by sheet metal templates set perpendicular to face and tip of curve and not less than 2 inches longer than depth of curb. Firmly hold templates during placing of concrete, and allow templates to remain in place until concrete has set sufficiently to hold its shape. Remove templates while forms are still in place.

B. After concrete has sufficiently set for a minimum of 12 hours, remove forms and backfill spaces on each side. Compact earth in satisfactory manner without damaging concrete work.

C. Fill minor defects with mortar composed of one part Portland cement and two parts fine aggregate.

END OF SECTION
SECTION 02830
CHAIN LINK FENCES AND GATES

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS
A. Submittals: Product Data.

PART 2 - PRODUCTS

2.1 FENCE COMPONENTS
A. Fabric: Galvanized steel, 2-1/8-inch (54-mm) mesh, 0.113-inch- (2.87-mm-) diameter wire.
B. Posts and Rails: Galvanized-steel Schedule 40 pipe complying with ASTM F 1043 requirements for heavy duty industrial fence.
C. Tension Wire: Galvanized steel
D. Fittings and Accessories: Galvanized steel as follows:
   1. Post and Line Caps: Provide weathertight cap for each post. Provide line post caps with loop to receive tension wire or top rail.
   2. Post Brace Assembly: Same material as top rail with 3/8-inch- (9.5-mm-) diameter rod and adjustable tightener.
   3. Bottom and Center Rail: Same material as top rail with cap on each end.
E. Gate Posts, Swing Gates, Barbed Wire, and Accessories: Galvanized steel with galvanized hardware and accessories.

PART 3 - EXECUTION

3.1 INSTALLATION
A. Install fence to comply with ASTM F 567.
B. Setting Posts: Set posts in floor mounted brackets. Align posts vertically and align tops.

END OF SECTION
SECTION 02890

PAVEMENT MARKING AND TRAFFIC SIGNS

PART 1 - GENERAL

1.01 SECTION INCLUDES
   Requirements for striping pavement, and furnishing and installing traffic signs, parking stall wheel stops, and fire hydrant markers.

1.02 REFERENCES
   A. DOT Specifications - Florida Department of Transportation Standard Specifications for Road and Bridge Construction.
   B. Collier County DOT Standards, latest edition.

1.03 SUBMITTALS
   A. General: As specified in Section 01330 - Submittals
   B. Submit the sign manufacturer's certification that signs furnished meet the requirements of DOT Specifications to the Engineer prior to ordering signs.

1.04 QUALITY CONTROL
   A. DOT Specifications referred to in this Section are made a part of this Contract to the extent of such references, and shall be as binding upon the Contract as through reproduced herein in their entirety.
   B. In the event of a conflict between the referenced standards or between the standards and other Contract provisions, the more stringent requirement shall apply.

PART 2 - PRODUCTS

2.01 PAVEMENT MARKING
   Pavement stripes and parking stalls shall be thermoplastic marking meeting Florida DOT standards.

2.02 PARKING STALL WHEEL STOPS
   Parking stall wheel stops shall be standard precast concrete units painted with lettering or a number as designated by the Engineer.

2.03 REFLECTIVE MARKERS – FIRE HYDRANTS
   Reflective markers shall be installed in the pavement in accordance with DOT Specifications and Owner requirements.
2.04 TRAFFIC SIGNS

A. Traffic regulating signs, signposts and other materials shall conform to the colors, dimensions and requirements of DOT Specifications and County regulations.

B. Traffic regulating signs shall display the lettering and symbols required by the referenced specifications and standards.

PART 3 - EXECUTION

3.01 FABRICATION

Preparation of sign blanks and fabrication of reflectorized faces shall conform to the applicable requirements of DOT Specifications, Sections 700-4 and 700-5.

3.02 INSTALLATION

Erect signs and supports at the locations as shown on the Drawings and in accordance with DOT Specifications and County regulations.

3.03 PAINTING

The pavement shall be painted at the locations as shown on the Drawings and in accordance with DOT Specifications and County regulations.

END OF SECTION
SECTION 03300
CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals: Product Data, concrete mix designs and submittals required by ACI 301.

B. Ready-Mixed Concrete Producer Qualifications: ASTM C 94/C 94M.


PART 2 - PRODUCTS

2.1 MATERIALS

A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 deformed.

B. Plain Steel Wire: ASTM A 82, as drawn.

C. Plain-Steel Welded Wire Reinforcement: ASTM A 185, as drawn, flat sheet.


E. Portland Cement: ASTM C 150, Type I or II.

F. Fly Ash: ASTM C 618, Type C or F.

G. Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 100 or 120.

H. Silica Fume: ASTM C 1240, amorphous silica.

I. Aggregates: ASTM C 33, uniformly graded.

J. Synthetic Fiber: ASTM C 1116/C 1116M, Type III, polypropylene fibers, 1/2 to 1-1/2 inches (13 to 38 mm) long.


L. Chemical Admixtures: ASTM C 494, water reducing, high-range water reducing and water reducing and retarding. Do not use calcium chloride or admixtures containing calcium chloride.

M. Color Pigment: ASTM C 979, synthetic mineral-oxide pigments or colored water-reducing admixtures.
N. Vapor Retarder: Reinforced sheet, ASTM E 1745, Class A.

O. Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber, or ASTM D 1752, cork or self-expanding cork.

P. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.

Q. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B.

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

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

2.2 MIXES

A. Comply with ACI 301 requirements for concrete mixtures.

B. Normal-Weight Concrete: Prepare design mixes, proportioned according to ACI 301 and ACI 350 as appropriate, as follows:

1. Minimum Compressive Strength: As noted on the Contract Drawings.
2. Maximum Water-Cementitious Materials Ratio: 0.45
3. Slump Limit: 4 inches for concrete with verified slump of 3 to 4 inches before adding high-range water-reducing admixture or plasticizing admixture.
4. Air Content: Maintain within range permitted by ACI 301 and ACI 350 as appropriate. Do not allow air content of floor slabs to receive troweled finishes to exceed 3 percent.
5. Use fly ash, pozzolan, ground granulated blast-furnace slag, and silica fume as needed to reduce the total amount of portland cement, which would otherwise be used, by not less than 20 percent.

C. Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M and ASTM C 1116.

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

PART 3 - EXECUTION

3.1 CONCRETING
A. Construct formwork according to ACI 301 and maintain tolerances and surface irregularities within ACI 347R limits of Class A, 1/8 inch (3.2 mm) for concrete exposed to view and Class C, 1/2 inch (13 mm) for other concrete surfaces.

B. Place vapor retarder on prepared subgrade, with joints lapped 6 inches (150 mm) and sealed.

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

D. Install construction, isolation, and contraction joints where indicated. Install full-depth joint-filler strips at isolation joints.

E. Place concrete in a continuous operation and consolidate using mechanical vibrating equipment.

F. Protect concrete from physical damage, premature drying, and reduced strength due to hot or cold weather during mixing, placing, and curing.

G. Formed Surface Finish: Smooth-formed finish for concrete exposed to view, coated, or covered by waterproofing or other direct-applied material; rough-formed finish elsewhere.

H. Slab Finishes: Comply with ACI 302.1R for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces. Provide the following finishes:

1. Scratch finish for surfaces to receive mortar setting beds.
2. Float finish for interior steps and ramps and surfaces to receive waterproofing, roofing, or other direct-applied material.
3. Troweled finish for floor surfaces and floors to receive floor coverings, paint, or other thin film-finish coatings.
4. Trowel and fine-broom finish for surfaces to receive thin-set tile.
5. Nonslip-broom finish to exterior concrete platforms, steps, and ramps.

I. Cure formed surfaces by moist curing for at least seven days.

J. Begin curing concrete slabs after finishing. Keep concrete continuously moist for at least seven days or apply membrane-forming curing compound to concrete. Contractor to verify curing materials and methods acceptable to flooring (high performance coating) manufacturer.

K. Owner will engage a testing agency to perform field tests and to submit test reports.

L. Protect concrete from damage. Repair surface defects in formed concrete and slabs.

M. Housekeeping Pads: Refer to Section 15125.

END OF SECTION
SECTION 03410
PRECAST STRUCTURAL CONCRETE

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals: Product Data, Shop Drawings, and structural analysis data signed and sealed by a qualified professional engineer.

B. Fabricator Qualifications: Fabricator participates in PCI's Plant Certification Program and is designated a PCI-certified plant, Product Group C.

C. Comply with ACI 318 (ACI 318M); PCI MNL 120, "PCI Design Handbook - Precast and Prestressed Concrete"; PCI MNL 116, "Manual for Quality Control for Plants and Production of Precast and Prestressed Concrete Products"; AWS D1.1/D.1.1M; and AWS D1.4.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide precast structural concrete units capable of withstanding design loadings indicated.

B. Provide units with fire resistance indicated, calculated according to ACI 216.1/TMS 0216.1, "Standard Method for Determining Fire Resistance of Concrete and Masonry Construction Assemblies”; or PCI MNL 124, "Design for Fire Resistance of Precast Prestressed Concrete."

2.2 MATERIALS

A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 deformed.

B. Steel Wire: ASTM A 82, plain, cold drawn.

C. Steel-Welded Wire Reinforcement: ASTM A 185, as drawn, flat sheet.


E. Prestressing Strand: ASTM A 416/A 416M, Grade 250 (Grade 1720) or Grade 270 (Grade 1860), uncoated, seven-wire, low-relaxation strand.

F. Portland Cement: ASTM C 150, Type I or Type III.

G. Fly Ash: ASTM C 618, Class C or F.
H. Metakaolin Admixture: ASTM C 618, Class N.

I. Silica Fume: ASTM C 1240, amorphous silica.

J. Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 100 or 120.

K. Normal-Weight Aggregates: ASTM C 33, with coarse aggregates complying with Class 4S.


M. Chemical Admixtures: ASTM C 494/C 494M, high-range water reducing and water reducing and retarding. Do not use admixtures containing chlorides.

2.3 ACCESSORIES AND FINISHES

A. Steel Shapes and Plates: ASTM A 36/A 36M.

B. Stainless steel bolts, nuts and studs shall be Type 316.

C. Zinc-Coated Finish: For items indicated for galvanizing, apply zinc coating by hot-dip process according to ASTM A 123/A 123M or ASTM A 153/A 153M.

D. Shop-Primed Finish: Prepare surfaces of nongalvanized-steel items, except those surfaces to be embedded in concrete, according to requirements in SSPC-SP 3, and shop apply lead- and chromate-free, rust-inhibitive primer according to SSPC-PA 1.

E. Bearing Pads: High-density plastic bearing pad strips.

F. Grout: ASTM C 1107, nonmetallic, nonshrink grout.

2.4 CONCRETE MIX

A. Proportion normal-weight concrete mixes to provide the following properties:

1. Compressive Strength: 5000 psi (34.5 MPa) at 28 days.
2. Water-Cementitious Materials Ratio: 0.40 maximum.
3. Air Content: 5.5 to 7.5 percent for concrete exposed to freezing and thawing, 2.5 to 4.5 percent elsewhere.
4. Use fly ash, pozzolan, ground granulated blast-furnace slag, and silica fume as needed to reduce the total amount of portland cement, which would otherwise be used, by not less than 20 percent.
5. Limit use of fly ash to 25 percent replacement of portland cement by weight and granulated blast-furnace slag to 40 percent of portland cement by weight; metakaolin and silica fume to 10 percent of portland cement by weight.

B. Concrete Mixing: Comply with ASTM C 94.

C. Finishes: Standard Commercial for formed surfaces. [Trowel unformed surfaces].
D. Replace precast concrete units deficient in strength, manufacturing tolerances, and finishes.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install bearing pads level, true, and on uniform bearing surfaces.

B. Protect precast units and bearing pads from damage during welding.

C. Install precast units level, plumb, square, and true, within the recommended erection tolerances of PCI MNL 135, "Tolerance Manual for Precast and Prestressed Concrete Construction."

D. Shore and brace precast concrete units to maintain location, stability, and alignment until permanent connections are installed.

E. Grout open spaces at keyways, connections, and joints after precast concrete units have been placed and secured.

F. Clean exposed surfaces of precast concrete units after erection.

END OF SECTION
SECTION 04720
CAST STONE MASONRY

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals:
   1. Product Data, Shop Drawings
   2. Samples: For cast stone and mortar.

B. Manufacturer Qualifications: A plant certified by the Cast Stone Institute, Architectural
   Precast Association or Precast/Prestressed Concrete Institute for Group A, Category AT.

PART 2 - PRODUCTS

2.1 CAST STONE UNITS

A. Provide cast stone units complying with ASTM C 1364.
   1. Provide units that are resistant to freezing and thawing.
   2. Slope exposed horizontal surfaces 1:12 unless otherwise indicated.
   3. Provide raised fillets at backs of sills and at ends indicated to be built into jamb.
   4. Provide drips on projecting elements unless otherwise indicated.

B. Colors and Textures: As selected, to match color and texture of split faced CMU veneer.

2.2 ACCESSORIES

A. Anchors and Dowels: Type 304 stainless steel.

B. Proprietary Acidic Cleaner: Product expressly approved for intended use by cleaner
   manufacturer and manufacturer of cast stone units.

C. Mortar: ASTM C 270, proportion specification.
   1. Use masonry cement mortar.
   2. For setting mortar, use Type N.
   3. For pointing mortar, use Type N.
   4. Pigmented Mortar: Use colored cement product or select and proportion pigments with other ingredients to produce color required.
PART 3 - EXECUTION

3.1 SETTING CAST STONE

A. Install cast stone units to comply with requirements in Division 04 Section "Unit Masonry."

B. Set units in full bed of mortar with full head joints unless otherwise indicated.
   1. Fill dowel holes and anchor slots with mortar.
   2. Fill collar joints solid as units are set.
   3. Build concealed flashing into mortar joints as units are set.
   4. Keep head joints in coping and other units with exposed horizontal surfaces open to receive sealant.
   5. Keep joints at shelf angles open to receive sealant.

C. Rake out joints for pointing with mortar to depths of not less than 3/4 inch (19 mm).

D. Point mortar joints by placing mortar in layers not greater than 3/8 inch (10 mm) thick. Compact each layer thoroughly and allow it to become thumbprint hard before applying next layer.

E. Tool exposed joints slightly concave when thumbprint hard unless otherwise indicated.

F. Provide expansion, control, and pressure-relieving joints of widths and at locations indicated. Keep joints free of mortar and other rigid materials.

G. Prepare joints indicated to receive sealant and apply sealant of type and at locations indicated to comply with applicable requirements in Division 07 Section "Joint Sealants."

3.2 CLEANING

A. In-Progress Cleaning: Clean cast stone as work progresses. Remove mortar fins and smears before tooling joints. Remove excess sealant immediately.

B. Final Cleaning: After mortar is thoroughly set and cured, clean exposed cast stone to comply with requirements in Division 04 Section "Unit Masonry."

END OF SECTION
SECTION 04810
UNIT MASONRY ASSEMBLIES

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals:
   1. Samples for decorative (split-face) concrete masonry units, and colored mortar.
   2. Material Certificates: For each type of product indicated. Include statements of material properties indicating compliance with requirements.

B. Comply with ACI 530.1/ASCE 6/TMS 602.

C. Testing and Inspecting: The Contractor will engage special inspectors to perform tests and inspections required by authorities having jurisdiction.
   1. Inspections Level 1: special inspections according to the IBC.
   2. Place grout only after inspectors have verified compliance of grout spaces and of grades, sizes, and locations of reinforcement.

D. Sample Panels of standard masonry units and of decorative (split-face) CMU: Construct a sample wall panel of each type approximately 48 inches long by 48 inches high to demonstrate aesthetic effects and set quality standards for materials and execution. Remove panels from the site after substantial completion of the building.

PART 2 - PRODUCTS

2.1 MASONRY UNITS

A. Concrete Masonry Units: ASTM C 90; Density Classification, Normal Weight.
   1. Integral Water Repellent: ACM Chemistries; RainBloc BASF Aktiengesellschaft; Rheopel Plus or Grace Construction Products, W. R. Grace & Co. - Conn.; Dry-Block.
   2. Special shapes for lintels, corners, jambs, sash, control joints, and other special conditions.
   3. Square-edged units for outside corners unless otherwise indicated.

B. Decorative Concrete Masonry Units: ASTM C 90; Density Classification, Normal Weight.
   1. Finish: Exposed faces with split-face finish.
   2. Integral Water Repellent: ACM Chemistries; RainBloc BASF Aktiengesellschaft; Rheopel Plus or Grace Construction Products, W. R. Grace & Co. - Conn.; Dry-Block.
3. Special shapes for lintels, corners, jambs, sash, control joints, and other special conditions.

C. Concrete Lintels: Precast units matching concrete masonry units and with reinforcing bars indicated or required to support loads indicated.

1. Available Products:
   a. Cast-Crete concrete lintels.


3. Special shapes for applications where stretcher units cannot accommodate special conditions, including those at corners, movement joints, bond beams, sashes, and lintels.

2.2 MORTAR AND GROUT

A. Mortar: ASTM C 270, proportion specification.

1. Use portland cement-lime or masonry cement mortar.

2. Do not use calcium chloride in mortar.

3. For masonry below grade or in contact with earth, use Type S.

4. For reinforced masonry, use Type N.

5. For exterior, above-grade, load-bearing and non-load-bearing walls and parapet walls; for interior load-bearing walls; for interior non-load-bearing partitions, and for other applications where another type is not indicated, use Type N.

6. Colored Mortar: For decorative concrete masonry units use colored cement or cement-lime mix of color selected.

7. Water-Repellent Additive: For mortar used with concrete masonry units made with integral water repellent, use product recommended by manufacturer of units.

B. Grout: ASTM C 476 with a slump of 8 to 11 inches (200 to 280 mm).

C. Refractory Mortar: Ground fireclay mortar or other refractory mortar that passes ASTM C 199 test and is acceptable to authorities having jurisdiction.

2.3 REINFORCEMENT, TIES, AND ANCHORS

A. Steel Reinforcing Bars: ASTM A 615/A 615M or ASTM A 996/A 996M, Grade 60

B. Joint Reinforcement: ASTM A 951.

1. Coating: Hot-dip galvanized at both interior and exterior walls.

2. Wire Size for Side Rods: 0.148-inch (3.77-mm) diameter.

3. Wire Size for Cross Rods: 0.148-inch (3.77-mm) diameter.

4. Wire Size for Veneer Ties: 0.148-inch (3.77-mm) diameter.

5. For single-wythe masonry, provide either ladder design or truss design.

6. For multiwythe masonry, provide ladder design with three side rods.
C. Corrugated-Metal Veneer Anchors: 7/8 inch (22 mm) wide and made from 0.060-inch-(1.52-mm-) thick stainless-steel sheet.

D. Veneer Anchors: Stainless-steel, two-piece adjustable masonry veneer anchors that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall, for attachment over sheathing to studs, and acceptable to authorities having jurisdiction.

2.4 EMBEDDED FLASHING MATERIALS

A. Sheet Metal Flashing: Stainless steel, 0.0156 inch (0.4 mm) thick

B. Rubberized Asphalt Sheet Flashing: Pliable, adhesive rubberized-asphalt compound, bonded to a polyethylene film to produce an overall thickness of 0.040 inch (1.02 mm). Use only where flashing is fully concealed.

C. Elastomeric Thermoplastic Flashing: Composite flashing product consisting of a polyester-reinforced ethylene interpolymer alloy, 0.025 inch (0.64 mm) thick, with a 0.015-inch- (0.38-mm-) thick coating of adhesive. Use only where flashing is fully concealed.

2.5 MISCELLANEOUS MASONRY ACCESSORIES


B. Preformed Control-Joint Gaskets: Designed to fit standard sash block and to maintain lateral stability in masonry wall; made from styrene-butadiene rubber or PVC.

C. Weep Holes: Round polyethylene tubing, 3/8-inch (9.5-mm) OD.

D. Cavity Drainage Material: Free-draining polymer mesh, full depth of cavity with dovetail shaped notches that prevent mortar clogging.

E. Polyisocyanurate Board Insulation: ASTM C 1289, Type I, Class 2; aluminum-foil faced.

F. Proprietary Acidic Masonry Cleaner: Product expressly approved for intended use by cleaner manufacturer and manufacturer of masonry units.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Cut masonry units with saw. Install with cut surfaces and, where possible, cut edges concealed.
B. Mix units for exposed unit masonry from several pallets or cubes as they are placed to produce uniform blend of colors and textures.

C. Matching Existing Masonry: Match coursing, bonding, color, and texture of existing masonry.

D. Stopping and Resuming Work: Rack back units; do not tooth.

E. Fill cores in hollow concrete masonry units with grout 24 inches (600 mm) under bearing plates, beams, lintels, posts, and similar items unless otherwise indicated.

F. Build non-load-bearing interior partitions full height and install compressible filler in joint between top of partition and underside of structure above.

G. Tool exposed joints slightly concave when thumbprint hard unless otherwise indicated.

H. Keep cavities clean of mortar droppings and other materials during construction.

I. Set firebox brick in full bed of refractory mortar with full head joints. Make joints approximately 1/8 inch (3 mm) wide and tool smooth.

J. Set clay flue liners in full beds of refractory mortar to comply with ASTM C 1283.

3.2 LINTELS

A. Install lintels where indicated.

B. Minimum bearing of 8 inches (200 mm) at each jamb unless otherwise indicated.

3.3 FLASHING AND WEEP HOLES

A. Install embedded flashing and weep holes in masonry at shelf angles, lintels, ledges, other obstructions to the downward flow of water in the wall, and where indicated.

B. Place through-wall flashing on sloping bed of mortar and cover with mortar. Seal penetrations in flashing before covering with mortar.

1. Extend flashing 4 inches (100 mm) into masonry at each end and turn up 2 inches (50 mm) to form a pan.

C. Trim wicking material used in weep holes flush with outside face of wall after mortar has set.

3.4 PARGING

A. Parge masonry walls, where indicated, in two uniform coats with a steel-trowel finish. Form a wash at top of parging and a cove at bottom. Damp cure parging for at least 24 hours.
3.5 CLEANING

A. Clean masonry as work progresses. Remove mortar fins and smears before tooling joints.

B. Final Cleaning: After mortar is thoroughly cured, clean exposed masonry.
   1. Wet wall surfaces with water before applying acidic cleaner, then remove cleaner promptly by rinsing thoroughly with clear water.
   2. Clean masonry with a proprietary acidic cleaner applied according to manufacturer's written instructions.

END OF SECTION
PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals: Shop Drawings.

B. Comply with applicable provisions of the following:
   1. AISC 303.
   2. AISC 341 and AISC 341s1.
   3. AISC 360.
   4. RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

PART 2 - PRODUCTS

2.1 STRUCTURAL STEEL

A. W-Shapes: ASTM A 992/A 992M or ASTM A 572/A 572M, Grade 50 (345).

B. Channels, Angles: ASTM A 36/A 36M.

C. Plate and Bar: ASTM A 36/A 36M, Grade 50 (345).

D. Cold-Formed Hollow Structural Sections: ASTM A 500, Grade B, structural tubing.

E. Steel Pipe: ASTM A 53, Type E or S, Grade B.

2.2 ACCESSORIES

A. Stainless Steel Bolts, Nuts, and Washers: ANSI Type 316.

B. Anchor Rods: ANSI Type 316.

C. Primer: Fabricator's standard lead- and chromate-free, nonasphaltic, rust-inhibiting primer.

D. Grout: ASTM C 1107, nonmetallic, shrinkage resistant, factory packaged.

2.3 FABRICATION

A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate according to AISC's "Code of Standard Practice for Steel Buildings and Bridges" and AISC 360.
B. Weld Connections: Comply with AWS D1.1/D1.1M[ and AWS D1.8/D1.8M] for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.

C. Shop Priming: Prepare surfaces according to SSPC-SP 2, "Hand Tool Cleaning"; or SSPC-SP 3, "Power Tool Cleaning." Shop prime steel to a dry film thickness of at least 1.5 mils (0.038 mm). Do not prime surfaces to be embedded in concrete or mortar or to be field welded.

PART 3 - EXECUTION

3.1 ERECTION

A. Set structural steel accurately in locations and to elevations indicated and according to AISC 303 and AISC 360.


1. Set plates for structural members on wedges, shims, or setting nuts as required.
2. Weld plate washers to top of base plate.
3. Snug-tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
4. Promptly pack grout solidly between bearing surfaces and plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure.

C. Align and adjust various members forming part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact with members. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.

D. Do not use thermal cutting during erection unless approved by Engineer. Finish thermally cut sections within smoothness limits in AWS D1.1/D1.1M.

E. High-Strength Bolts: Install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.

1. Joint Type: Snug tightened.

F. Weld Connections: Comply with AWS D1.1/D1.1M and AWS D1.8/D1.8M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.

END OF SECTION
SECTION 05500
METAL FABRICATIONS

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals: Shop Drawings showing details of fabrication and installation.

PART 2 - PRODUCTS

2.1 METALS

A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

B. Stainless-Steel Sheet, Strip, Plate, and Flat Bars: ASTM A 240/A 240M or ASTM A 666, Type 304.

C. Stainless-Steel Bars and Shapes: ASTM A 276, Type 304.

D. Rolled Steel Floor Plate: ASTM A 786/A 786M.

E. Steel Tubing: ASTM A 500.

F. Steel Pipe: ASTM A 53, standard weight (Schedule 40), black finish.

G. Slotted Channel Framing: Cold-formed steel channels, 1-5/8 by 3-5/8 inches by 0.0528 inch thick, complying with MFMA-4.

H. Cast Iron: ASTM A 48/A 48M or ASTM A 47/A 47M.


K. Aluminum Castings: ASTM B 26/B 26M, Alloy 443.0-F.

2.2 GROUT

A. Nonshrink, Nonmetallic Grout: ASTM C 1107; recommended by manufacturer for exterior applications.
2.3  FABRICATION

A. General: Shear and punch metals cleanly and accurately. Remove burrs and ease exposed edges. Form bent-metal corners to smallest radius possible without impairing work.

B. Welding: Weld corners and seams continuously. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals. At exposed connections, finish welds and surfaces smooth with contour of welded surface matching those adjacent.

C. Fabricate nosings from cast iron with an integral abrasive finish.

   1. Apply bituminous paint to concealed surfaces of units set into concrete.

D. Fabricate nosings, and treads from extruded aluminum with abrasive filler consisting of aluminum-oxide or silicon-carbide grits, or a combination of both, in an epoxy-resin binder.

   1. Ribbed, Solid-abrasive-type units.
   2. Apply clear lacquer to concealed surfaces of units set into concrete.

2.4  STEEL AND IRON FINISHES

A. Hot-dip galvanize steel fabrications at exterior locations where specifically shown on the Contract Drawings.

B. Prepare uncoated ferrous metal surfaces to comply with SSPC-SP 3, "Power Tool Cleaning," and paint with a fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79.

PART 3 - EXECUTION

3.1  INSTALLATION

A. Perform cutting, drilling, and fitting required for installing miscellaneous metal fabrications. Set metal fabrication accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack.

B. Fit exposed connections accurately together to form hairline joints.

C. Coat concealed surfaces of aluminum that will come into contact with grout, concrete, masonry, wood, or dissimilar metals with a heavy coat of bituminous paint.

END OF SECTION
SECTION 05520
METAL RAILINGS

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals: Product Data, Shop Drawings, structural analysis data signed and sealed by a qualified professional engineer registered in the state where Project is located and manufacturer's color charts showing the full range of colors available for factory-applied finishes.

PART 2 - PRODUCTS

2.1 RAILING SYSTEMS

A. Available Manufacturers:
   1. Moultree Manufacturing C., Wesrail II safety railing system

B. Provide railings capable of withstanding a uniform load of 50 lbf/ ft. (0.73 kN/m) and a concentrated load of 200 lbf (0.89 kN) applied to handrails and top rails of guards in any direction. Uniform and concentrated loads need not be assumed to act concurrently.

C. Provide railing infill capable of withstanding a concentrated load of 50 lbf (0.22 kN) applied horizontally on an area of 1 sq. ft. (0.093 sq. m). Infill load and other railing loads need not be assumed to act concurrently.

2.2 METALS

A. Aluminum, Extruded Bars and Tubing: ASTM B 221 (ASTM B 221M), Alloy 6063-T5/T52.


C. Stainless-Steel Tubing: ASTM A 554, Grade MT 304.

D. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

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

A. Nonshrink, Nonmetallic Grout: ASTM C1107; recommended by manufacturer for exterior applications.

2.4 FABRICATION

A. Assemble railing systems in shop to the greatest extent possible. Use connections that maintain structural value of joined pieces.

B. Form changes in direction of railing members by use of prefabricated fittings.

C. Fabricate railing systems and handrails for connecting members, with concealed mechanical fasteners and fittings.

D. Provide manufacturer’s standard wall brackets, flanges, miscellaneous fittings, and anchors to connect handrail and railing members to other construction.

E. Provide wall returns at ends of wall-mounted handrails.

2.5 FINISHES

A. Aluminum Railings: Class I, clear anodic finish; AA-M12C22A41; complying with AAMA 611

PART 3 - EXECUTION

3.1 INSTALLATION

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

B. Set railings accurately in location, alignment, and elevation and free of rack.

C. Coat concealed surfaces of aluminum that will be in contact with cementitious materials or dissimilar metals, with a heavy coat of bituminous paint.

D. Anchor posts in concrete by forming or core-drilling holes 5 inches (125 mm) deep and 3/4 inch (20 mm) greater than OD of post. Fill annular space between post and concrete with nonshrink, nonmetallic grout.

E. Attach handrails to wall with wall brackets.

END OF SECTION
PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals: ICC-ES evaluation reports for wood-preservative treated wood, engineered wood products and metal framing anchors.

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS, GENERAL

A. Lumber: Provide dressed lumber, S4S, marked with grade stamp of inspection agency.

B. Engineered Wood Products: Acceptable to authorities having jurisdiction and for which current model code research or evaluation reports exist that show compliance with building code in effect for Project.

2.2 TREATED MATERIALS

A. Preservative-Treated Materials: AWPA C2[, except that lumber not in ground contact and not exposed to the weather may be treated according to AWPA C31 with inorganic boron (SBX)].

1. Use treatment containing no arsenic or chromium.
2. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent.
3. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.

B. Provide preservative-treated materials for all rough carpentry unless otherwise indicated. items indicated on Drawings, and the following:

1. Wood members in connection with roofing, flashing, vapor barriers, and waterproofing.
2. Concealed members in contact with masonry or concrete.
3. Wood framing members that are less than 18 inches (460 mm) above the ground.
4. Wood floor plates that are installed over concrete slabs-on-grade.

C. Fire-Retardant-Treated Materials: Comply with performance requirements in AWPA C20.

1. Use Exterior type for exterior locations and where indicated.
2. Use Interior Type A, High Temperature (HT) for enclosed roof framing, framing in attic spaces, and where indicated.
3. Use Interior Type A unless otherwise indicated.
4. Identify with appropriate classification marking of a testing and inspecting agency acceptable to authorities having jurisdiction.

D. Provide fire-retardant treated materials for items indicated on Drawings.

2.3 LUMBER

A. Dimension Lumber:
   1. Maximum Moisture Content: 19 percent
   2. Retain one grade requirement and one or more species group in first two subparagraphs below depending on availability and suitability for Project. Designate load-bearing walls on Drawings.
   3. Framing Other Than Non-Load-Bearing Interior Partitions: Construction or No. 2; Southern pine: SPIB (south).
   4. Exposed Framing: Provide material hand-selected for uniformity of appearance and freedom from characteristics, on exposed surfaces and edges, that would impair finish appearance, including decay, honeycomb, knot-holes, shake, splits, torn grain, and wane.
      a. Species: As specified for framing other than non-load-bearing interior partitions.
      b. Grade: No. 2.

B. Miscellaneous Lumber: Construction, or No. 2 grade with 19 percent maximum moisture content of any species. Provide for nailers, blocking, and similar members.

2.4 ENGINEERED WOOD PRODUCTS

A. Engineered wood products with allowable design stresses, as published by manufacturer, that meet or exceed those indicated. Manufacturer's published values shall be demonstrated by comprehensive testing.

2.5 PLYWOOD BACKING PANELS

A. Telephone and Electrical Equipment Backing Panels: Plywood, Exterior, AC Plugged], fire-retardant treated, not less than 3/4-inch nominal thickness.

2.6 MISCELLANEOUS PRODUCTS

A. Fasteners: Size and type indicated. Provide fasteners with Type 316 stainless steel.
B. Metal Framing Anchors: Structural capacity, type, and size indicated.
1. Use anchors made from hot-dip galvanized steel complying with ASTM A 653/A 653M, G60 (Z180) coating designation for interior locations where stainless steel is not indicated.
2. Use anchors made from stainless steel complying with, Type 316 unless noted otherwise.

C. Sill Sealer: Glass-fiber insulation, 1 inch thick, compressible to 1/32 inch Closed-cell neoprene foam, 1/4 inch thick.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Locate nailers, blocking, and similar supports to comply with requirements for attaching other construction.

B. Securely attach rough carpentry to substrates, complying with the following:

1. CABO NER-272 for power-driven fasteners.
2. Published requirements of metal framing anchor manufacturer.
3. Table 2304.9.1, "Fastening Schedule," in the IBC

END OF SECTION
SECTION 06402
INTERIOR ARCHITECTURAL WOODWORK

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals: Drawings and Samples showing the full range of colors, textures, and patterns available for each type of finish.


C. Environmental Limitations: Do not deliver or install woodwork until building is enclosed, wet work is completed, and HVAC system is operating.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Hardboard: AHA A135.4.

B. Medium-Density Fiberboard: ANSI A208.2, Grade 130, made with binder containing no urea formaldehyde.

C. Particleboard: ANSI A208.1, Grade M-2, Straw-based particleboard complying with requirements of ANSI A208.1, Grade M-2, except for density.
   1. Semiconcealed Hinges for Overlay Doors: BHMA A156.9, B01521.

D. Frameless Concealed Hinges (European Type): BHMA A156.9, B01602, 170 degrees of opening.

E. Wire Pulls: Back mounted, solid metal, 4 inches long, 5/16 inch in diameter.

F. Catches: Ball friction catches, BHMA A156.9, B03013.

G. Adjustable Shelf Standards and Supports: BHMA A156.9, B04071; with shelf rests, B04081 BHMA A156.9, B04102; with shelf brackets, B04112.

H. Drawer Slides: BHMA A156.9, B05091.
   1. Box Drawer Slides: Grade 1.
   2. File Drawer Slides: Grade 1.
   3. Pencil Drawer Slides: Grade 1.

I. Drawer Locks: BHMA A156.11, E07041.
J. Grommets for Cable Passage through Countertops: 2-inch OD, molded-plastic grommets and matching plastic caps with slot for wire passage.

K. Exposed Hardware Finishes: Comply with BHMA A156.18 for BHMA code number indicated.
   1. Finish: Stainless Steel: BHMA 630.

L. Furring, Blocking, Shims, and Hanging Strips: Softwood or hardwood lumber, kiln dried to 15 percent moisture content.

2.2 INTERIOR WOODWORK

A. Complete fabrication to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.

B. Plastic-Laminate Cabinets: Custom grade.
   1. AWI Type of Cabinet Construction: Flush overlay
   2. WIC Construction Style: Style A, Frameless
   3. WIC Door and Drawer Front Style: Flush overlay]
   4. Laminate Cladding: Horizontal surfaces other than tops, HGS; postformed surfaces, HGP; vertical surfaces, HGS VGS; Edges, HGS VGS ; 0.12 inch (3 mm) thick; semiexposed surfaces, VGS CLS
   5. Drawer Sides and Backs: Thermoset decorative panels.

C. Plastic-Laminate Countertops: Custom grade.
   1. Laminate Grade: HGS for flat countertops, HGP for post-formed countertops.
   2. Grain Direction: Parallel to cabinet fronts.
   3. Edge Treatment: Same as laminate cladding on horizontal surfaces.
   4. Fabricate tops in one piece with shop-applied backsplashes and edges.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Before installation, condition woodwork to average prevailing humidity conditions in installation areas.

B. Install woodwork to comply with referenced quality standard for grade specified.

C. Install woodwork level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb (including tops) to a tolerance of 1/8 inch in 96 inches (3 mm in 2400 mm).
D. Scribe and cut woodwork to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.

E. Anchor woodwork to anchors or blocking built in or directly attached to substrates. Fasten with countersunk concealed fasteners and blind nailing. Use fine finishing nails or finishing screws for exposed nailing, countersunk and filled flush with woodwork.

F. Standing and Running Trim: Install with minimum number of joints possible, using full-length pieces (from maximum length of lumber available) to greatest extent possible. Do not use pieces less than 36 inches (900 mm) long, except where shorter single-length pieces are necessary. Scarf running joints and stagger in adjacent and related members.

G. Anchor paneling to supports with concealed panel-hanger clips and by blind nailing on back-up strips, splined-connection strips, and similar associated trim and framing.

H. Stairs: Securely anchor carriages to supporting substrates. Install stairs with treads and risers no more than 1/8 inch (3 mm) from indicated position.

I. Railings:
   1. Stair Rails: Glue and dowel or pin balusters to treads and railings, and railings to newel posts.
   2. Wall Rails: Support rails on indicated metal brackets securely fastened to wall framing.

J. Cabinets: Install so doors and drawers are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation.
   1. Fasten wall cabinets through back, near top and bottom, at ends and not more than 16 inches (400 mm) o.c. with No. 10 wafer-head sheet metal screws through metal backing or metal framing behind wall finish.

K. Anchor countertops securely to base units. Seal space between backsplash and wall.

L. Softwood Plywood: DOC PS 1.

M. Hardwood Plywood and Face Veneers: HPVA HP-1, made with adhesive containing no urea formaldehyde.

N. High-Pressure Decorative Laminate: NEMA LD 3.
   1. Available Products:
      a. Wilsonart Laminate
      b. Formica
3.2 CABINET HARDWARE AND ACCESSORY MATERIALS

A. Butt Hinges: 2-3/4-inch 5-knuckle steel hinges made from 0.095-inch-thick metal, and as follows:

END OF SECTION
SECTION 07111
BITUMINOUS DAMPPROOFING

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals: Product Data.

PART 2 - PRODUCTS

2.1 BITUMINOUS DAMPPROOFING

A. Cold-Applied, Emulsified-Asphalt Dampproofing:
   1. Available Manufacturers:
      a. Grace
      b. Sonneborn
      c. Euclid
   2. Trowel Coats: ASTM D 1227, Type II, Class 1.


C. Emulsified-Asphalt Primer: ASTM D 1227, Type III, Class 1, except diluted with water as recommended by manufacturer.

D. Asphalt-Coated Glass Fabric: ASTM D 1668, Type I.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Clean substrates of projections and substances detrimental to work; fill voids, seal joints, and apply bond breakers if any, as recommended by prime material manufacturer.

B. Comply with manufacturer's written recommendations unless more stringent requirements are indicated or required by Project conditions to ensure satisfactory performance of dampproofing.
C. Apply dampproofing to footings and foundation walls where opposite side of wall faces building interior.

1. Apply from finished-grade line to top of footing, extend over top of footing, and down a minimum of 6 inches (150 mm) over outside face of footing.
2. Install flashings and corner protection stripping at internal and external corners, changes in plane, construction joints, cracks, and where shown as "reinforced," by embedding an 8-inch- (200-mm-) wide strip of asphalt-coated glass fabric in a heavy coat of dampproofing. Dampproofing coat for embedding fabric is in addition to other coats required.

D. Apply dampproofing to provide continuous plane of protection on exterior face of inner wythe of exterior masonry cavity walls.

1. Lap dampproofing at least 1/4 inch (6 mm) onto flashing and items that penetrate inner wythe.
2. Extend dampproofing over outer face of structural members and concrete slabs.

E. Apply dampproofing to provide continuous plane of protection on interior face of above-grade, exterior concrete and masonry walls unless walls are indicated to receive direct application of paint.

F. Cold-Applied Emulsified-Asphalt Dampproofing:

1. On concrete and parged masonry foundation walls, apply two brush or spray coats, one fibered brush or spray coat, or one trowel coat.
2. On unparged masonry foundation walls, apply primer and two brush or spray coats, primer and one fibered brush or spray coat, or primer and one trowel coat.
3. On Concrete Backup for CMU Veneer Assemblies: Apply one brush or spray coat.
4. On Exterior Face of Inner Wythe of Cavity Walls: Apply primer and one brush or spray coat.
5. On Interior Face of Exterior Concrete Walls: Where above grade and indicated to be furred and finished, apply one brush or spray coat.
6. On Interior Face of Single-Wythe Exterior Masonry Walls: Where above grade and indicated to be furred and finished, apply primer and one brush or spray coat.

END OF SECTION
PART 1 - GENERAL

1.1 SECTION REQUIREMENTS
   A. Submittals: Product Data.

PART 2 - PRODUCTS

2.1 INSULATION PRODUCTS
   A. Surface-Burning Characteristics: ASTM E 84, and as follows:
      1. Flame-Spread Index: 25 or less where exposed; otherwise, as indicated in Part 2 "Insulation Products" Article.
      2. Smoked-Developed Index: 450 or less.
   B. Foil-Faced Polyisocyanurate Board Insulation: ASTM C 1289, Type I, Class 1 or 2, faced on both sides with aluminum foil, with flame-spread index of 75 or less for unfaced core material.
   C. Mineral-Fiber-Blanket Insulation: ASTM C 665, Type I, unfaced with fibers manufactured from glass, slag wool, or rock wool, with flame-spread index of 25 or less.

PART 3 - EXECUTION

3.1 INSTALLATION
   A. Install insulation in areas and in thicknesses indicated or required to produce R-values indicated. Cut and fit tightly around obstructions and fill voids with insulation.
   B. Except for loose-fill insulation and insulation that is friction fitted in stud cavities, bond units to substrate with adhesive or use mechanical anchorage to provide permanent placement and support of units.
   C. Extend vapor retarder to extremities of areas to be protected from vapor transmission. Secure in place with adhesives or other anchorage. Locate seams at framing members, overlap, and seal with tape.

END OF SECTION
SECTION 07521

STYRENE-BUTADIENE-STYRENE (SBS) MODIFIED BITUMINOUS MEMBRANE ROOFING

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS


B. Warranties: Manufacturer’s standard or customized form, without monetary limitation, signed by roofing manufacturer agreeing to repair leaks due to defects in materials or workmanship for period of 20 years.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Energy Performance: Initial Solar Reflectance not less than 0.70 and Thermal Emittance not less than 0.75 when tested according to CRRC-1.

B. Exterior Fire-Test Exposure: ASTM E 108, Class A

C. Available Manufacturer’s: Siplast

2.2 ROOFING MATERIALS

A. Glass-Fiber Base-Ply Sheet: ASTM D 2178, Type IV, asphalt-impregnated, glass-fiber felt.

B. Roofing Membrane Sheet: ASTM D 6164, Grade S, Type I or II, SBS-modified asphalt sheet (reinforced with polyester fabric) smooth surfaced.

C. Granule-Surface Roofing Membrane Cap Sheet: ASTM D 6164, Grade G, Type I or II, SBS-modified asphalt sheet (reinforced with polyester fabric), white synthetic chips surface w/ 70% solar reflectance per ASTM D 1549..

D. Auxiliary Materials: Recommended by roofing system manufacturer for intended use and as follows:

2. Flashing Backer Sheet: ASTM D 5147, Grade S, Type I or II, SBS-modified asphalt sheet (reinforced with polyester fabric); smooth surfaced.

2.3 ROOFING INSULATION

A. Polyisocyanurate Board Insulation: ASTM C 1289, Type II. 3” min. thickness, R-21.

B. Cover Board: ASTM C 1177/C 1177M, glass-mat, water-resistant gypsum substrate, Type X, 1/2 inch (13 mm) thick.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install substrate board with long joints continuous and perpendicular to roof slopes with end joints staggered. Tightly butt substrate boards together and adhere to concrete deck.

B. Install each layer of insulation in a solid mopping of hot asphalt. Prime surface of concrete deck with asphalt primer allow primer to dry before mopping in and applying first layer.

C. Mechanically fasten each first layer of insulation with at least one fastener for each 4 sq. ft. (0.38 sq. m) and at least two fasteners per board. Install subsequent layers in a solid mopping of hot asphalt.

D. Install cover boards over insulation with long joints continuous and perpendicular to roof slopes with end joints staggered. Loosely butt cover boards together and fasten to deck.

E. Install and secure cant strips and nailer strips.

F. Install roofing membrane system according to roofing system manufacturer's written instructions, applicable recommendations in ARMA/NRCA's "Quality Control Guidelines for the Application of Polymer Modified Bitumen Roofing," and as follows:

1. Deck Type: I (insulated).
4. Number of Glass-Fiber Base-Ply Sheets: One.
5. Number of SBS-Modified Asphalt Sheets: Two.
6. Surfacing Type: White reflective synthetic chips to achieve .70% solar reflectance (ASTM D 1549)

G. Maintain uniform side and staggered end laps. Bond and seal laps, leaving no voids.
H. Application of roofing membrane components shall immediately follow application of base sheet and/or insulation as a continuous operation.

I. Priming: Prime metal and concrete surfaces with a uniform coating of the specified asphalt primer.

J. Bitumen Consistency: Cutting or alterations of bitumen, primer, and sealants will not be permitted.

K. Roofing Application: Apply all layers of roofing free of wrinkles, creases and fishmouths. Exert sufficient pressure on the roll during application to ensure prevention of air pockets.

L. Flashing: Extend 8 inches (200 mm) above roof and 4 inches (100 mm) onto roof and secure to substrate.

M. Synthetic Chip Embedment: Broadcast synthetic chips over bitumen/adhesive overruns on the finish ply surface.

END OF SECTION
PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals: Product Data, Shop Drawings.

B. Comply with SMACNA's "Architectural Sheet Metal Manual." Conform to dimensions and profiles shown unless more stringent requirements are indicated.

C. Coordinate installation of sheet metal flashing and trim with interfacing and adjoining construction to provide a leakproof, secure, and noncorrosive installation.

PART 2 - PRODUCTS

2.1 SHEET METAL

A. Aluminum Sheet: ASTM B 209 (ASTM B 209M), alloy as standard with manufacturer for finish required, not less than 0.032 inch (0.8 mm) thick; and finished as follows:
   1. Finish: Manufacturer’s standard two-coat fluoropolymer system with color coat containing not less than 70 percent PVDF resin by weight.
   2. Concealed Finish: Manufacturer’s standard white or light-colored acrylic or polyester backer finish.

B. Stainless-Steel Sheet: ASTM A 240/A 240M, Type 304, with No. 2D finish; not less than 0.016 inch (0.4 mm) thick.

2.2 ACCESSORIES

A. Felt Underlayment: ASTM D 226, Type II (No. 30), asphalt-saturated organic felts.

B. Self-Adhering Sheet Underlayment, High Temperature: Butyl or SBS-modified asphalt; slip-resisting-polyethylene surfaced; with release paper backing; cold applied. Stable after testing at 240 deg F (116 deg C) and passes after testing at minus 20 deg F (29 deg C); ASTM D 1970.

C. Slip Sheet: Building paper, 3-lb/100 sq. ft. (0.16-kg/sq. m) minimum, rosin sized.

D. Fasteners: Wood screws, annular-threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners.
   1. Exposed Fasteners: Heads matching color of sheet metal roofing using plastic caps or factory-applied coating.
2. Spikes and Ferrules: Same material as gutter; with spike with ferrule matching internal gutter width.

3. Fasteners for Aluminum Sheet: Aluminum or Series 300 stainless steel.

4. Fasteners for Stainless-Steel Sheet: Series 300 stainless steel.

E. Solder for Stainless Steel: ASTM B 32, Grade Sn60, with acid flux of type recommended by stainless-steel sheet manufacturer.

F. Butyl Sealant: ASTM C 1311, solvent-release butyl rubber sealant.

G. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D 1187.

2.3 FABRICATION

A. Fabricate sheet metal flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to the design, dimensions, metal, and other characteristics of the item indicated.

B. Expansion Provisions: Where lapped expansion provisions cannot be used, form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with butyl sealant concealed within joints.

C. Fabrication Tolerances: Fabricate sheet metal flashing and trim that is capable of installation to tolerances specified in MCA's "Guide Specification for Residential Metal Roofing."

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with SMACNA's "Architectural Sheet Metal Manual." Allow for thermal expansion; set true to line and level. Install Work with laps, joints, and seams permanently watertight and weatherproof; conceal fasteners where possible.

B. Sealed Joints: Form nonexpansion, but movable, joints in metal to accommodate elastomeric sealant to comply with SMACNA standards.

C. Fabricate nonmoving seams in sheet metal with flat-lock seams.[ For aluminum, form seams and seal with epoxy seam sealer. Rivet joints for additional strength.]

D. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter. Pretin edges of sheets to be soldered to a width of 1-1/2 inches (38 mm), except where pretinned surface would show in finished Work.

1. Do not solder aluminum sheet.
2. Do not pretin zinc-tin alloy-coated stainless steel.
3. Do not use torches for soldering. Heat surfaces to receive solder and flow solder into joint. Fill joint completely. Completely remove flux and spatter from exposed surfaces.
E. Aluminum Flashing and Trim: Coat back side of aluminum flashing and trim with bituminous coating where it will contact wood, ferrous metal, or cementitious construction.

F. Separate dissimilar metals with a bituminous coating or polymer-modified, bituminous sheet underlayment.

END OF SECTION
SECTION 07710
ROOF SPECIALTIES

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals: Product Data.

B. Warranties: Provide manufacturer's standard written warranty, signed by manufacturer agreeing to promptly repair or replace roof specialties that show evidence of deterioration of factory-applied finishes within 15 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Aluminum Sheet: ASTM B 209 (ASTM B 209M), alloy as standard with manufacturer for finish required.

B. Aluminum Extrusions: ASTM B 221 (ASTM B 221M), alloy and temper as recommended by manufacturer for use and finish indicated.

C. Aluminum Finish: Two-coat fluoropolymer system with color coat containing not less than 70 percent PVDF resin by weight.

D. Stainless-Steel Sheet: ASTM A 240/A 240M, Type 304, No. 4 (fine directional satin) finish.

E. Felt Underlayment: ASTM D 226, Type II (No. 30), asphalt-saturated organic felts.

F. Self-Adhering Sheet Underlayment, High Temperature: Butyl or SBS-modified asphalt; slip-resisting-polyethylene surfaced; with release paper backing; cold applied. Stable after testing at 240 deg F (116 deg C) and passes after testing at minus 20 deg F (29 deg C); ASTM D 1970.

G. Fasteners: Manufacturer's recommended fasteners, suitable for application and designed to meet performance requirements.

2. Fasteners for Aluminum: Aluminum or Series 300 stainless steel.
3. Fasteners for Stainless-Steel Sheet: Series 300 stainless steel.

H. Butyl Sealant: ASTM C 1311, solvent-release butyl rubber sealant.
I. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D 1187.

2.2 ROOF SPECIALTIES

A. SPRI Wind Design Standard: Provide roof-edge flashings tested according to SPRI ES-1 and capable of resisting the following design pressures:

1. Design Pressure: As indicated on Drawings.

B. Gutters and Downspouts:

1. Available Products:
   a. Atas
   b. Architectural Products, Co.

2. Gutters: Manufactured in uniform section lengths, with matching corner units, ends, outlet tubes, and other accessories. Elevate back edge at least 1 inch (25 mm) above front edge. Furnish expansion joints, and expansion-joint covers.
   a. Gutter Style: Rectangular.
   b. Aluminum: 0.050 inch (1.27 mm) thick.
   c. Gutter Supports: Gutter brackets, straps with finish matching the gutters.

3. Downspouts: Plain rectangular with mitered elbows. Furnish wall brackets of same material and finish as downspouts, with anchors.
   a. Aluminum 0.050 inch (1.27 mm) thick.

C. Reglets: Manufactured units formed to provide secure interlocking of separate reglet and counterflashing pieces. Provide reglets with slotted holes for fastening to substrate, with neoprene or other suitable weatherproofing washers, and with channel for sealant at top edge.
   1. Formed Aluminum: 0.050 inch (1.27 mm) thick.

D. Counterflashings: Manufactured units of heights to overlap top edges of base flashings by 4 inches (100 mm) designed to snap into reglets or through-wall-flashing receiver and compress against base flashings with joints lapped.
   1. Formed Aluminum: 0.024 inch (0.61 mm) thick.
PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Install roof specialties according to manufacturer’s written instructions. Anchor roof specialties securely in place, with provisions for thermal and structural movement.

B. Coat back side of aluminum, stainless-steel roof specialties with bituminous coating where they will contact wood, ferrous metal, or cementitious construction.

C. Separate dissimilar metals with a bituminous coating or polymer-modified, bituminous sheet underlayment.

D. Bed flanges in thick coat of asphalt roofing cement where required by manufacturers of roof specialties for waterproof performance.

E. Space movement joints at a maximum of 12 feet (3.6 m) with no joints within 18 inches (450 mm) of corners or intersections unless indicated.

   1. Install gutter with expansion joints at locations indicated but not exceeding 50 feet (15.2 m) apart. Install expansion joint caps.

F. Fastener Sizes: Use fasteners of sizes that will penetrate wood blocking or sheathing not less than 1-1/4 inches (32 mm) for nails and not less than 3/4 inch (19 mm) for wood screws.

G. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter. Pretin edges of sheets to be soldered to a width of 1-1/2 inches (38 mm), except where pretinned surface would show in finished Work.

H. Gutters: Join and seal gutter lengths. Allow for thermal expansion. Attach gutters to firmly anchored gutter supports spaced not more than 24 inches (610 mm) apart. Attach ends with rivets and seal with sealant to make watertight. Slope to downspouts.

I. Downspouts: Join sections with manufacturer’s standard telescoping joints. Provide hangers with fasteners designed to hold downspouts securely to walls and 1 inch (25 mm) away from walls; locate fasteners at top and bottom and at approximately 60 inches (1500 mm) o.c. Also install straps approx. 8” above and below the split face CMU veneer.

J. Reglets: Install reglets to receive flashings where flashing without embedded reglets is indicated on Drawings. Install at height so that inserted counterflashings overlap 4 inches (100 mm) over top edge of base flashings.

END OF SECTION
SECTION 07841

PENETRATION FIRESTOPPING

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals: Product Data and Installer certificates signed by Installer certifying that products have been installed in compliance with requirements.

PART 2 - PRODUCTS

2.1 PENETRATION FIRESTOPPING

A. Provide penetration firestopping materials that are compatible with one another, substrates, and penetrating items if any.

B. Penetrations in Fire-Resistance-Rated Walls and Horizontal Assemblies: Provide penetration firestopping with ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg (2.49 Pa).
   1. F-Rating at Fire-Resistance-Rated Walls: Not less than that of construction penetrated.
   2. F-Rating at Horizontal Assemblies: At least 1 hour, but not less than that of construction penetrated.
   3. T-Rating at Horizontal Assemblies: At least 1 hour, but not less than the fire-resistance rating of construction penetrated except for penetrations within the cavity of a wall.

C. Penetrations in Smoke Barriers: Provide penetration firestopping with ratings determined per UL 1479.
   1. L-Rating: Not exceeding 5.0 cfm/sq. ft. (0.025 cu. m/s per sq. m) of penetration opening at 0.30-inch wg (74.7 Pa) at both ambient and elevated temperatures.

D. Exposed Penetration Firestopping: Provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.

E. Accessories: Provide components for each penetration firestopping system that are needed to install fill materials and to maintain ratings required. Use only those components specified by penetration firestopping manufacturer and approved by qualified testing and inspecting agency.
PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Install penetration firestopping to comply with manufacturer’s written installation instructions and published drawings for products and applications indicated.

B. Identify penetration firestopping with preprinted metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches (150 mm) of firestopping edge so labels will be visible to anyone seeking to remove penetrating items or firestopping. Include the following information on labels:

1. The words "Warning - Penetration Firestopping - Do Not Disturb. Notify Building Management of Any Damage."
2. Designation of applicable testing and inspecting agency.
3. Manufacturer's name.
4. Installer's name.

C. Contractor will engage a qualified testing agency to perform tests and inspections.

END OF SECTION
SECTION 08110
ACOUSTIC RATED HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals: Product Data and Shop Drawings including doors, frames, perimeter seals, door bottoms, thresholds, cam-lift hinges, hardware standoff brackets where required and other items required for complete STC rated assemblies. Provide test reports from a qualified accredited testing agency as described in Part 2, G below.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Cold-Rolled Steel Sheets: ASTM A 1008/A 1008M, suitable for exposed applications.

B. Hot-Rolled Steel Sheets: ASTM A 1011/A 1011M, free of scale, pitting, or surface defects.

C. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, G60 (Z180) or A60 (ZF180).

D. Frame Anchors: ASTM A 591/A 591M, 40Z (12G) coating designation; mill phosphatized.

1. For anchors built into exterior walls, sheet steel complying with ASTM A 1008/A 1008M or ASTM A 1011/A 1011M, hot-dip galvanized according to ASTM A 153/A 153M, Class B.

E. Inserts, Bolts, and Fasteners: Stainless steel, Type 316

F. Provide acoustic assemblies manufactured by a single firm specializing in the production of this type of work for a minimum of five years and has a successful history of products provided to the architect.

G. Assemblies provided shall be identical to those tested at an independent acoustical laboratory qualified under the National Voluntary Laboratory Accreditation Program (NVLAP) by the National Institute for Science and Technology (NIST) in accordance with ASTM E90 and ASTM E413. Test reports will contain the laboratory name, test report number and date of test.

2.2 HOLLOW METAL DOORS AND FRAMES

A. Products:
1. As designed and manufactured by Security Acoustics, Division of Security Metal Products Corporation. STC rating to be 50.

B. Fire-Rated Doors and Frames: Labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, based on testing at as close to neutral pressure as possible according to NFPA 252.

C. Smoke-Control Door Assemblies: Comply with NFPA 105 or UL 1784.

D. Doors: Complying with ANSI 250.8 for level and model and ANSI A250.4 for physical-endurance level indicated, 1-3/4 inches (44 mm) thick unless otherwise indicated.

1. Interior Doors: Level 2 and Physical Performance Level B (Heavy Duty), Model 1 (Full Flush). Stainless steel face sheets. 16 Ga.
   a. Thermal-Rated (Insulated) Doors: Where indicated, provide doors with thermal-resistance value (R-value) of not less than 6.0 deg F x h x sq. ft./Btu (1.057 K x sq. m/W) when tested according to ASTM C 1363.

2. Hardware Reinforcement: Fabricate according to ANSI/SDI A250.6 with reinforcement plates from same material as door face sheets.

E. Frames: ANSI A250.8; conceal fastenings unless otherwise indicated.- Type 316 St. Stl.

1. Steel Sheet Thickness for Interior Doors: As recommended by manuf.
2. Fabricate interior frames with mitered or coped and continuously welded corners. 14 Ga.
3. Hardware Reinforcement: Fabricate according to ANSI/SDI A250.6 with reinforcement plates from same material as frames.
4. Frame Anchors: Not less than 0.042 inch (1.0 mm) thick.

F. Glazing and Stops: Nonremovable stops on outside of exterior doors and on secure side of interior doors; screw-applied, removable, glazing stops on inside, fabricated from same material as door face sheet in which they are installed. Factory installed acoustical glazing.

G. Door Silencers: Three on strike jambs of single-door frames and two on heads of double-door frames.

H. Grout Guards: Provide where mortar might obstruct hardware operation.

I. Prepare doors and frames to receive door manuf. provided hardware according to ANSI A250.6 and ANSI A115 Series standards.

J. Reinforce doors and frames to receive surface-applied hardware.

K. Prime Finish: Manufacturer's standard, factory-applied coat of lead- and chromate-free primer complying with ANSI/SDI A250.10 acceptance criteria.
PART 3 - EXECUTION

3.1 INSTALLATION

A. Install hollow metal frames to comply with ANSI/SDI A250.11.

   1. Fire-Rated Frames: Install according to NFPA 80.

B. Install doors to provide clearances between doors and frames as indicated in ANSI/SDI A250.11.

C. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying rust-inhibitive primer.

D. Installation and storage of doors and frames: NAAMM/HMMA 840-99.

END OF SECTION
SECTION 08111
HOLLOW METAL DOOR FRAMES

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS
A. Submittals: Product Data and Shop Drawings.

PART 2 - PRODUCTS

2.1 MATERIALS
A. Cold-Rolled Steel Sheets: ASTM A 1008/A 1008M, suitable for exposed applications.
B. Hot-Rolled Steel Sheets: ASTM A 1011/A 1011M, free of scale, pitting, or surface defects.
C. Stainless Steel Sheet, Type 316 w/ #4 finish.
D. Frame Anchors: ASTM A 591/A 591M, 40Z (12G) coating designation; mill phosphatized.
   1. For anchors built into exterior walls, sheet steel complying with ASTM A 1008/A 1008M or ASTM A 1011/A 1011M, hot-dip galvanized according to ASTM A 153/A 153M, Class B.
E. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A 153/A 153M.

2.2 HOLLOW METAL DOOR FRAMES
A. Available Products:
   1. Ceco.
B. Fire-Rated Frames: Labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, based on testing at positive pressure according to NFPA 252 or UL 10B.
   1. Interior fire-rated doors provide doors that that have a temperature rise rating of 450 deg F (250 deg C).
C. Smoke-Control Door Assemblies: Comply with NFPA 105 or UL 1784.
D. Frames: ANSI A250.8; conceal fastenings unless otherwise indicated.
   1. Stainless Steel Sheet Thickness for Interior Doors 0.053 inch (1.3 mm).
2. Fabricate interior frames with mitered or coped and continuously welded corners.
3. Hardware Reinforcement: Fabricate according to ANSI/SDI A250.6 with reinforcement plates from same material as frames.
4. Frame Anchors: Not less than 0.042 inch (1.0 mm) thick.

E. Glazing Stops: Nonremovable stops on outside of exterior doors and on secure side of interior doors; screw-applied, removable, glazing stops on inside, fabricated from same material as door face sheet in which they are installed.

F. Door Silencers: Three on strike jambs of single-door frames and two on heads of double-door frames.

G. Grout Guards: Provide where mortar might obstruct hardware operation.

H. Prepare doors and frames to receive mortised and concealed hardware according to ANSI A250.6 and ANSI A115 Series standards.

I. Reinforce doors and frames to receive surface-applied hardware.

J. Prime Finish: Manufacturer's standard, factory-applied coat of lead- and chromate-free primer complying with ANSI/SDI A250.10 acceptance criteria.

**PART 3 - EXECUTION**

3.1 INSTALLATION

A. Install hollow metal frames to comply with ANSI/SDI A250.11.

   1. Fire-Rated Frames: Install according to NFPA 80.

B. Install doors to provide clearances between doors and frames as indicated in ANSI/SDI A250.11.

C. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying rust-inhibitive primer.

**END OF SECTION**
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 interior and exterior aluminum frames for doors installed in gypsum board partitions and CMU walls. Aluminum frames are not to be used for fire rated interior doors.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, fire-resistance rating, compliance with the Florida Building Code for windspeed and impact load requirements and finishes.

B. Shop Drawings: Include the following:
   1. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
   2. Locations of reinforcements and preparations for hardware.
   3. Details of each different wall-opening condition.
   4. Details of anchorages, joints, field splices, and connections.
   5. Details of accessories.
   6. Details of moldings, removable stops, and glazing.
   7. Details of conduits and preparations for power, signal, and control systems.

C. Samples for Initial Selection: For units with factory-applied finishes.
   1. Include similar Samples of seals, gaskets, and accessories involving color selection.

D. Schedule: For interior aluminum frames. Use same designations indicated on Drawings. Coordinate with door hardware schedule and glazing.

E. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each type of interior and exterior aluminum frame.

F. Maintenance Data: For aluminum frames to include maintenance manuals.
1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain interior aluminum frames from single source from single manufacturer.

B. Fire-Rated Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252 or UL 10C.

C. Smoke- and Draft-Control Assemblies: Where indicated, provide assemblies tested according to UL 1784 and installed in compliance with NFPA 105.

1. Air Leakage Rate: Maximum air leakage of 0.3 cfm/sq. ft. (3 cu. m per minute/sq. m) at the tested pressure differential of 0.3-inch wg (75 Pa) of water.

D. Preinstallation Conference: Conduct conference at Project site.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver interior aluminum frames palletized, wrapped, or crated to provide protection during transit and Project-site storage. Do not use nonvented plastic. Store interior aluminum frames under cover at Project site.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings <Special-Lite, Inc. > or comparable product by one of the following:

1. Advanced Architectural Frames.
2. Custom Components Company.
4. Frameworks Manufacturing.
5. Interior Components Inc.
6. Modulex, Inc; Division of Pacific National Group.
7. RACO Interior Products, Inc.
8. Versatrac.
9. Western Integrated Materials, Inc.

2.2 COMPONENTS

A. Aluminum Framing: ASTM B 221 (ASTM B 221M), Alloy 6063-T5 or alloy and temper required to suit structural and finish requirements, not less than 0.062 inch (1.6 mm) thick.
B. Door Frames: Extruded aluminum, reinforced for hinges, strikes, and closers.
   1. 90-Minute Fire-Protection Rating: Fabricate aluminum frame assemblies with a cold-formed, primed, interior steel liner.
C. Glazing Frames: Extruded aluminum, for glazing thickness indicated.
D. Ceiling Tracks: Extruded aluminum.
E. Trim: Extruded aluminum, not less than 0.062 inch (1.6 mm) thick, with removable snap-in glazing stops and door stops without exposed fasteners.

2.3 ACCESSORIES
   A. Fasteners: Aluminum, nonmagnetic, stainless-steel or other noncorrosive metal fasteners compatible with frames, stops, panels, reinforcement plates, hardware, anchors, and other items being fastened.
   B. Door Silencers: Manufacturer's standard continuous mohair, wool pile, or vinyl seals grey color.
   C. Smoke Seals: Intumescent strip or fire-rated gaskets; grey color.
   D. Glazing Gaskets: Manufacturer's standard extruded or molded plastic, to accommodate glazing thickness indicated; grey.
   E. Hardware: Comply with requirements in Division 08 door hardware Sections. Frames to accommodate specified acoustical hardware at interior doors.

2.4 FABRICATION
   A. Provide concealed corner reinforcements and alignment clips for accurately fitted hairline joints at butted or mitered connections.
   B. Factory prepare interior aluminum frames to receive templated mortised hardware; include cutouts, reinforcements, mortising, drilling, and tapping, according to the Door Hardware Schedule and templates furnished as specified in Division 08 Section "Door Hardware."
      1. Locate hardware as required by fire-rated label for assembly.
   C. Fabricate frames for glazing with removable stops to allow glazing replacement without dismantling frame.
      1. Locate removable stops on the inside of spaces accessed by keyed doors.
   D. Fabricate components to allow secure installation without exposed fasteners.
2.5 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

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

2.6 ALUMINUM FINISHES

A. Clear Anodic Finish: AAMA 611, AA-M12C22A31, Class II, 0.010 mm or thicker.

B. High-Performance Organic Finish: Two-coat fluoropolymer finish complying with AAMA 2604 and containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.


PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine walls, floors, and ceilings, with Installer present, for conditions affecting performance of the Work.

B. Verify that wall thickness does not exceed standard tolerances allowed by throat size indicated.

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

3.2 INSTALLATION

A. General: Install interior aluminum frames plumb, rigid, properly aligned, and securely fastened in place; comply with manufacturer's written instructions.

B. Set frames accurately in position and plumbed, aligned, and securely anchored to substrates.

1. At fire-protection-rated openings, install interior aluminum frames according to NFPA 80.

C. Install frame components in the longest possible lengths; components up to 96 inches (2450 mm) long must be one piece.
1. Fasten to suspended ceiling grid on maximum 48-inch (1220-mm) centers, using sheet metal screws or other fasteners approved by frame manufacturer.
2. Use concealed installation clips to produce tightly fitted and aligned splices and connections.
3. Secure clips to extruded main-frame components and not to snap-in or trim members.
4. Do not leave screws or other fasteners exposed to view when installation is complete.

3.3 CLEANING

A. Clean exposed frame surfaces promptly after installation, using cleaning methods recommended by frame manufacturer and according to AAMA 609 & 610.

B. Touch up marred frame surfaces so touchup is not visible from a distance of 48 inches (1220 mm). Remove and replace frames with damaged finish that cannot be satisfactorily repaired.

END OF SECTION
SECTION 08161
INTERIOR FRP CLAD AND INTERIOR FRP CLAD FIRE-RATED DOORS

PART 1     GENERAL

1.1 SECTION INCLUDES
A. Fiberglass reinforced polyester (FRP) clad fire-rated doors.

1.2 RELATED SECTIONS
A. Section 08100 - Metal Doors and Frames: Fire-rated hollow metal frames.
B. Section 08710 - Door Hardware.

1.3 REFERENCES
A. ASTM D 256 - Determining the Pendulum Impact Resistance of Notched Specimens of Plastics.
C. ASTM D 570 - Water Absorption of Plastics.
D. ASTM D 638 - Tensile Properties of Plastics.
I. NFPA 252 - Fire Tests of Door Assemblies.
J. UBC Standard 7-2 - Fire Tests of Door Assemblies.
K. UL 10C - Positive Pressure Fire Tests of Door Assemblies.

1.4 PERFORMANCE REQUIREMENTS
A. General: Provide door assemblies that have been designed and fabricated to comply with specified performance requirements, as demonstrated by testing manufacturer's corresponding standard systems.

B. 90-Minute Full-Scale Vertical Fire Test of Doors, Positive Pressure: Complied with acceptance criteria for 90-minute rating.
   1. UBC Standard 7-2.
   2. NFPA 252.
   3. UL 10C.
C. Surface Burning Characteristics, Class A Faces of FRP Interior Panels, ASTM E 84:
   1. Flame Spread: Maximum of 25.
   2. Smoke Developed: Maximum of 450.

D. Surface Burning Characteristics, Class C Faces of FRP Exterior Panels, ASTM E 84:
   1. Flame Spread: Maximum of 200.
   2. Smoke Developed: Maximum of 450.

D. Impact Strength, FRP Doors and Panels, Nominal Value, ASTM D 256: 15.0 foot-pounds per inch of notch.

E. Tensile Strength, FRP Doors and Panels, Nominal Value, ASTM D 638: 14,000 psi.

F. Flexural Strength, FRP Doors and Panels, Nominal Value, ASTM D 790: 21,000 psi.

G. Water Absorption, FRP Doors and Panels, Nominal Value, ASTM D 570: 0.20 percent after 24 hours.


I. Abrasion Resistance, Face Sheet, Taber Abrasion Test, 25 Cycles at 1,000 Gram Weight with CS-17 Wheel: Maximum of 0.029 average weight loss percentage.

J. Stain Resistance, ASTM D 1308: Face sheet unaffected after exposure to red cabbage, tea, and tomato acid. Stain removed easily with mild abrasive or FRP cleaner when exposed to crayon and crankcase oil.

   1. Acetic acid, Concentrated.
   2. Ammonium Hydroxide, Concentrated.
   3. Citric Acid, 10%.
   4. Formaldehyde.
   5. Hydrochloric Acid, 10%
   6. Sodium hypochlorite, 4 to 6 percent solution.

1.5 SUBMITTALS

A. Comply with Section 01330 - Submittal Procedures.

B. Product Data: Submit manufacturer's product data, including description of materials, components, and installation.

C. Shop Drawings: Submit manufacturer's shop drawings, including elevations, sections, and details, indicating dimensions, tolerances, materials, components, and fabrication.

D. Samples:
   1. Door: Submit manufacturer's sample of door showing face sheets, core, finish, and vision lites.
   2. Color: Submit manufacturer's samples of standard colors of doors.

E. Test Reports: Submit certified test reports from qualified independent testing agency indicating
doors comply with specified performance requirements.

G. Maintenance Manual: Submit manufacturer's maintenance and cleaning instructions for doors, including maintenance and operating instructions for hardware.

H. Warranty: Submit manufacturer's standard warranty.

1.6 QUALITY ASSURANCE

A. Manufacturer's Qualifications:
   1. Continuously engaged in manufacturing of doors of similar type to that specified, with a minimum of 25 years successful experience.
   2. Door and frame components from same manufacturer.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Delivery: Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying opening door mark and manufacturer.

B. Storage: Store materials in clean, dry area indoors in accordance with manufacturer's instructions.

C. Handling: Protect materials and finish from damage during handling and installation.

1.8 WARRANTY

A. Warrant doors and factory hardware against failure in materials and workmanship, including excessive deflection, faulty operation, defects in hardware installation, and deterioration of finish or construction in excess of normal weathering.

B. Warranty Period: Ten years.

PART 2 PRODUCTS

2.1 MANUFACTURER


2.2 FRP CLAD FIRE-RATED DOORS

A. Model: SL-21 45-minute fire-rated doors with SpecLite3 FRP face sheets.

B. Door Opening Size: As indicated on the Drawings.

C. Construction:
   1. Door Thickness: 1-7/8 inches at door edge.
   2. Stiles and Rails: Stainless steel channel secured with stainless steel screws every 10 inches.
D. Face Sheets:
   1. Material: FRP
   2. Thickness: 0.120 inch.
   4. Color: To be selected from manufacturer's standard colors.
   5. Sheet Type: Class A FRP

E. Core:
   2. Density: Minimum 30 pounds per cubic foot.

F. Cutouts:
   1. Manufacture doors with cutouts for required vision lites.
   2. Factory install vision lites.

G. Door Perimeter Channel: Type 304 stainless steel, 3/4 inch by 1-7/8 inches by 0.062 inch.

H. Fasteners:
   1. Material: Aluminum, 18-8 stainless steel, or other noncorrosive metal.
   2. Compatibility: Compatible with items to be fastened.
   3. Exposed Fasteners: Screws with finish matching items to be fastened.

I. Fire-Rated Hollow Metal Frames: As specified in Section 08100 (08 12 13).

2.3 FABRICATION

A. Sizes and Profiles: Required sizes for door and profile requirements shall be as indicated on the Drawings.

B. Coordination of Fabrication: Field measure before fabrication and show recorded measurements on shop drawings.

C. Assembly:
   1. Complete cutting, fitting, forming, drilling, and grinding of metal before assembly.
   2. Remove burrs from cut edges.

D. Fit:
   1. Maintain continuity of line and accurate relation of planes and angles.
   2. Secure attachments and support at mechanical joints with hairline fit at contacting members.

2.4 FIRE-RATED HARDWARE

A. Hardware shall be fire rated.

B. Premachine doors in accordance with templates from specified hardware manufacturers and hardware schedule.
C. Factory install hardware, except field apply gaskets and seals.

D. Hardware Schedule: As specified in Section 08710 and As indicated on the Drawings.

E. Finish: As specified in Section 08710 and as indicated on the Drawings.

F. Gaskets and Seals supplied by manufacturer:

2.5 VISION LITES

A. Vision Lite Kit: Stainless steel.

B. Factory Glazing: 1/4-inch wire glass, clear or 3/16-inch NGP Firelite NT, clear.

C. Size: 10 inches by 10 inches.

2.6 ALUMINUM DOOR FRAMING SYSTEMS

A. Insert Framing System:
   2. Insert frame as indicated on the Drawings, using integral stop fitted with weatherstripping.
   3. Corner joints of miter design, secure with furnished aluminum clips, and screw into place.
   4. Hardware:
      a. Premachine and reinforce insert frame members for hardware in accordance with manufacturer's standards and hardware schedule.
      b. Factory install hardware.
   5. Anchors:
      a. Anchors of suitable type to fasten insert framing to existing frame materials.
      b. Minimum of 5 anchors on jambs up to 7'-4" height, 3 anchors on headers, and 1 additional anchor for each additional foot of frame.

B. Frame Capping:
   2. Capping: With insert frame as indicated on the Drawings.
   3. Finish: Match framing.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine areas to receive doors. Notify Architect of conditions that would adversely affect installation or subsequent use. Do not proceed with installation until unsatisfactory conditions are corrected.
3.2 PREPARATION
A. Ensure openings to receive frames are plumb, level, square, and in tolerance.

3.3 INSTALLATION
A. Install doors in accordance with manufacturer's instructions.
B. Install fire-rated hollow metal frames as specified in Section 08100.
C. Install doors plumb, level, square, true to line, and without warp or rack.
D. Install gaskets and seals to doors in accordance with manufacturer's instructions.
E. Repair minor damages to finish in accordance with manufacturer's instructions and as approved by Architect.
F. Remove and replace damaged components that cannot be successfully repaired as determined by Architect.

3.4 ADJUSTING
A. Adjust doors, hinges, and locksets for smooth operation without binding.

3.5 CLEANING
A. Clean doors promptly after installation in accordance with manufacturer’s instructions.
B. Do not use harsh cleaning materials or methods that would damage finish.

3.6 PROTECTION
A. Protect installed doors to ensure that, except for normal weathering, doors will be without damage or deterioration at time of substantial completion.

END OF SECTION
SECTION 08174
EXTERIOR FRP FLUSH DOORS

PART 1 GENERAL

1.1 SECTION INCLUDES
A. Exterior Fiberglass reinforced polyester (FRP) flush doors with aluminum frames.

1.2 RELATED SECTIONS
A. Section 08710 - Door Hardware.

1.3 REFERENCES
B. ANSI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors and Hardware Reinforcings.
D. ASTM B 209 - Aluminum and Aluminum-Alloy Sheet and Plate.
E. ASTM B 221 - Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
F. ASTM D 256 - Determining the Pendulum Impact Resistance of Notched Specimens of Plastics.
H. ASTM D 570 - Water Absorption of Plastics.
I. ASTM D 638 - Tensile Properties of Plastics.
L. ASTM D 1621 - Compressive Properties of Rigid Cellular Plastics.
M. ASTM D 1623 - Tensile and Tensile Adhesion Properties of Rigid Cellular Plastics.
N. ASTM D 2126 - Response of Rigid Cellular Plastics to Thermal and Humid Aging.
Q. ASTM D 6670-01 - Standard Practice for Full-Scale Chamber Determination of Volatile Organic Emissions from Indoor Materials/Products.
T. ASTM E 283 - Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.
V. ASTM E 331 - Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference.
W. ASTM F 476 - Security of Swinging Door Assemblies.
Y. NWWDA T.M. 7-90 – Cycle Slam Test Method
Z. SFBC PA 201 - Impact Test Procedures.
AA. SFBC PA 203 - Criteria for Testing Products Subject to Cyclic Wind Pressure Loading.
AB. SFBC 3603.2 (b)(5) - Forced Entry Resistance Test.

1.4 PERFORMANCE REQUIREMENTS

A. General: Provide door assemblies that have been designed and fabricated to comply with specified performance requirements, as demonstrated by testing manufacturer's corresponding standard systems.

B. Air Infiltration: For a single door 3'-0" x 7'-0", test specimen shall be tested in accordance with ASTM E 283 at pressure differential of 6.24 psf. Door shall not exceed 0.90 cfm per linear foot of perimeter crack.

C. Water Resistance: For a single door 3'-0" x 7'-0", test specimen shall be tested in accordance with ASTM E 331 at pressure differential of 7.50 psf. Door shall not have water leakage.

D. Indoor air quality testing per ASTM D 6670-01: GREENGUARD Environmental Institute Certified including GREENGUARD for Children and Schools Certification.

E. Hurricane Test Standards, Single Door with Single-Point Latching:
   1. Uniform Static Load, ASTM E 330: Plus or minus 75 pounds per square foot.
   2. Forced Entry Test, 300 Pound Load Applied, SFBC 3603.2 (b)(5): Passed.
   3. Cyclic Load Test, SFBC PA 203: Plus or minus 53 pounds per square foot.
   4. Large Missile Impact Test, SFBC PA 201: Passed.

F. Blast Test, Doors and Frames, ASTM F 1642-04, 6 psi / 41 psi-msec: Minimal Hazard.

G. Swinging Door Cycle Test, Doors and Frames, ANSI A250.4: Minimum of 25,000,000 cycles.

H. Cycle Slam Test Method, NWWDA T.M. 7-90: Minimum 5,000,000 Cycles.
I. Swinging Security Door Assembly, Doors and Frames, ASTM F 476: Grade 40.


L. Thermal Transmission, Exterior Doors, U-Value, AAMA 1503-98: Maximum of 0.29 BTU/hr x sf x degrees F. Minimum of 55 CRF value.

M. Surface Burning Characteristics, FRP Doors and Panels, ASTM E 84:
   1. Flame Spread: Maximum of 200, Class C.
   2. Smoke Developed: Maximum of 450, Class C.

N. Surface Burning Characteristics, Class A Option On Interior Faces of FRP Exterior Panels and Both Faces of FRP Interior Panels, ASTM E 84:
   1. Flame Spread: Maximum of 25.
   2. Smoke Developed: Maximum of 450.

O. Impact Strength, FRP Doors and Panels, Nominal Value, ASTM D 256: 15.0 foot-pounds per inch of notch.

P. Tensile Strength, FRP Doors and Panels, Nominal Value, ASTM D 638: 14,000 psi.

Q. Flexural Strength, FRP Doors and Panels, Nominal Value, ASTM D 790: 21,000 psi.

R. Water Absorption, FRP Doors and Panels, Nominal Value, ASTM D 570: 0.20 percent after 24 hours.


U. Abrasion Resistance, Face Sheet, Taber Abrasion Test, 25 Cycles at 1,000 Gram Weight with CS-17 Wheel: Maximum of 0.029 average weight loss percentage.

V. Stain Resistance, ASTM D 1308: Face sheet unaffected after exposure to red cabbage, tea, and tomato acid. Stain removed easily with mild abrasive or FRP cleaner when exposed to crayon and crankcase oil.

   1. Acetic acid, Concentrated.
   2. Ammonium Hydroxide, Concentrated.
   3. Citric Acid, 10%.
   4. Formaldehyde.
   5. Hydrochloric Acid, 10%
   6. Sodium hypochlorite, 4 to 6 percent solution.

X. Compressive Strength, Foam Core, Nominal Value, ASTM D 1621: 79.9 psi.

Y. Compressive Modulus, Foam Core, Nominal Value, ASTM D 1621: 370 psi.

Z. Tensile Adhesion, Foam Core, Nominal Value, ASTM D 1623: 45.3 psi.
AA. Thermal and Humid Aging, Foam Core, Nominal Value, 158 Degrees F and 100 Percent Humidity for 14 Days, ASTM D 2126: Minus 5.14 percent volume change.

1.5 SUBMITTALS

A. Comply with Section 01330 - Submittal Procedures.

B. Product Data: Submit manufacturer's product data, including description of materials, components, fabrication, finishes, and installation.

C. Shop Drawings: Submit manufacturer's shop drawings, including elevations, sections, and details, indicating dimensions, tolerances, materials, fabrication, doors, panels, framing, hardware schedule, and finish.

D. Samples:
   1. Door: Submit manufacturer's sample of door showing face sheets, core, framing, and finish.
   2. Color: Submit manufacturer's samples of standard colors of doors and frames.

E. Test Reports: Submit certified test reports from qualified independent testing agency indicating doors comply with specified performance requirements.

F. Manufacturer's Project References: Submit list of successfully completed projects including project name and location, name of architect, and type and quantity of doors manufactured.

G. Maintenance Manual: Submit manufacturer's maintenance and cleaning instructions for doors, including maintenance and operating instructions for hardware.

H. Warranty: Submit manufacturer's standard warranty.

1.6 QUALITY ASSURANCE

A. Manufacturer's Qualifications:
   1. Continuously engaged in manufacturing of doors of similar type to that specified, with a minimum of 25 years successful experience.
   2. Door and frame components from same manufacturer.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Delivery: Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying opening door mark and manufacturer.

B. Storage: Store materials in clean, dry area indoors in accordance with manufacturer's instructions.

C. Handling: Protect materials and finish from damage during handling and installation.

1.8 WARRANTY

A. Warrant doors, frames, and factory hardware against failure in materials and workmanship, including excessive deflection, faulty operation, defects in hardware installation, and deterioration of finish or construction in excess of normal weathering.
B. Warranty Period: Ten years starting on date of shipment. In addition, a limited lifetime (while the door is in its specified application in its original installation) warranty covering: failure of corner joinery, core deterioration, delamination or bubbling of door skin.

PART 2 PRODUCTS

2.1 MANUFACTURER


2.2 FRP FLUSH DOORS

A. Model: SL-17 Flush Doors with SpecLite3 fiberglass reinforced polyester (FRP) face sheets.

B. Door Opening Size: As indicated on the Drawings.

C. Construction:
   2. Stiles and Rails: Aluminum extrusions made from prime-equivalent billet that is produced from 100% reprocessed 6063-T5 alloy recovered from industrial processes, minimum of 2-5/16-inch depth.
   4. Provide joinery of 3/8-inch diameter full-width tie rods through extruded splines top and bottom integral to standard tubular shaped stiles and rails reinforced to accept hardware as specified.
   5. Securing Internal Door Extrusions: 3/16-inch angle blocks and locking hex nuts for joinery. Welds, glue, or other methods are not acceptable.
   6. Furnish extruded stiles and rails with integral reglets to accept face sheets. Lock face sheets into place to permit flush appearance.
   7. Rail caps or other face sheet capture methods are not acceptable.
   8. Extrude top and bottom rail legs for interlocking continuous weather bar.
   9. Meeting Stiles: Pile brush weatherseals. Extrude meeting stile to include integral pocket to accept pile brush weatherseals.
   10. Bottom of Door: Install bottom weather bar with nylon brush weatherstripping into extruded interlocking edge of bottom rail.
   11. Glue: Use of glue to bond sheet to core or extrusions is not acceptable.

D. Face Sheet:
   1. Material: SpecLite3 FRP, 0.120-inch thickness, finish color throughout.
   2. Protective coating: Abuse-resistant engineered surface. Provide FRP with SpecLite3 protective coating, or equal.
   4. Color: To be selected from Manufacturer’s standard colors.
   5. Adhesion: The use of glue to bond face sheet to foam core is prohibited.

E. Core:
   2. Density: Minimum of 5 pounds per cubic foot.
F. Cutouts:
1. Manufacture doors with cutouts for required vision lites, louvers, and panels.
2. Factory install vision lites, louvers, and panels.

G. Hardware:
1. Premachine doors in accordance with templates from specified hardware manufacturers and hardware schedule.
2. Factory install hardware.

2.3 MATERIALS

A. Aluminum Members:
1. Aluminum extrusions made from prime-equivalent billet that is produced from 100% reprocessed 6063-T5 alloy recovered from industrial processes: ASTM B 221.
2. Sheet and Plate: ASTM B 209.
3. Alloy and Temper: As required by manufacturer for strength, corrosion resistance, application of required finish, and control of color.

B. Components: Door and frame components from same manufacturer.

C. Fasteners:
2. Compatibility: Compatible with items to be fastened.
3. Exposed Fasteners: Screws with finish matching items to be fastened.

2.4 FABRICATION

A. Sizes and Profiles: Required sizes for door and frame units, and profile requirements shall be as indicated on the Drawings.

B. Coordination of Fabrication: Field measure before fabrication and show recorded measurements on shop drawings.

C. Assembly:
1. Complete cutting, fitting, forming, drilling, and grinding of metal before assembly.
2. Remove burrs from cut edges.

D. Welding: Welding of doors or frames is not acceptable.

E. Fit:
1. Maintain continuity of line and accurate relation of planes and angles.
2. Secure attachments and support at mechanical joints with hairline fit at contacting members.

2.5 ARCHITECTURAL PANELS

B. Face Sheets:
1. Material: SpecLite3 FRP, 0.120-inch thickness, finish color throughout. Abuse-resistant engineered surface.
2. Texture: Pebble.
3. Color: To be selected.
C. Insulated Speclite3 FRP Panels:
   1. Insulated Panels: Two 0.120-inch minimum thickness sheets.
   2. Core: Foam polyurethane core of a minimum of 5 pounds per cubic foot density.
   3. Form components to function as single unit.

D. Class A Flame Spread and Smoke Developed Rating:
   1. Class A flame spread and smoke developed rating on interior faces of exterior panels and both faces of interior panels.

2.6 ALUMINUM DOOR FRAMING SYSTEMS

A. Tubular Framing:
   1. Size and Type: As indicated on the Drawings.
   2. Materials: Aluminum extrusions made from prime-equivalent billet that is produced from 100% reprocessed 6063-T5 alloy recovered from industrial processes, 1/8-inch minimum wall thickness.
   3. Applied Door Stops: 0.625-inch high, with screws and weatherstripping. Door stop shall incorporate pressure gasketing for weathering seal. Counterpunch fastener holes in door stop to preserve full metal thickness under fastener head.
   4. Frame Members: Box type with 4 enclosed sides. Open-back framing is not acceptable.
   5. Caulking: Caulk joints before assembling frame members.
   6. Joints:
      a. Secure joints with fasteners.
      b. Provide hairline butt joint appearance.
   7. Field Fabrication: Field fabrication of framing using stick material is not acceptable.
   9. Hardware:
      a. Premachine and reinforce frame members for hardware in accordance with manufacturer's standards and hardware schedule.
      b. Factory install hardware.
   10. Anchors:
       a. Anchors appropriate for wall conditions to anchor framing to wall materials.
       b. Door Jamb and Header Mounting Holes: Maximum of 24-inch centers.
       c. Secure head and sill members of transom, side lites, and similar conditions.
   11. Side Lites:
       a. Factory preassemble side lites to greatest extent possible.
       b. Mark frame assemblies according to location.

B. Insert Framing System:

   1. Model: SL-1030 Series
   2. Insert frame as indicated on the Drawings, using integral stop fitted with weatherstripping.
   3. Corner joints of miter design, secure with furnished aluminum clips, and screw into place.
   4. Hardware:
      a. Premachine and reinforce insert frame members for hardware in accordance with manufacturer's standards and hardware schedule.
      b. Factory install hardware.
5. Anchors:
   a. Anchors of suitable type to fasten insert framing to existing frame materials.
   b. Minimum of 5 anchors on jambs up to 7'-4" height, 3 anchors on headers, and 1
      additional anchor for each additional foot of frame.

C. Frame Capping:
   2. Capping: With insert frame as indicated on the Drawings.
   3. Finish: Match framing.

2.7 HARDWARE

A. Premachine doors in accordance with templates from specified hardware manufacturers and
   hardware schedule.

B. Factory install hardware.

C. Hardware Schedule: As follows and as specified in Section 08710 and as indicated on the
   Drawings.
   2. Locking Hardware: Schlage, D-Series Rhodes.
   3. Flush Bolts/Surface Bolts: To be determined.

D. Finish: Clear As specified in Section 08710.

2.8 VISION LITES

A. Factory Glazing: 1 inch glass insulating units.

B. Lites in Exterior Doors: Allow for thermal expansion.

C. Rectangular Lites:
   2. Factory glazed with screw-applied aluminum stops anodized to match perimeter door rails.

   1. Frame Perimeter: Aluminum. Finish to match vision lite.
   2. Expanded Metal: 1/4-inch diameter, round hole perforated, 16-gauge stainless steel sheet.
      Powder coat black finish.

2.10 ALUMINUM FINISHES

A. Anodized Finish: Class I finish, 0.7 mils thick.

   1. Clear 215 R1, AA-M10C12C22A41, Class I, 0.7 mils thick.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine areas to receive doors. Notify Architect of conditions that would adversely affect
installation or subsequent use. Do not proceed with installation until unsatisfactory conditions are corrected.

3.2 PREPARATION
A. Ensure openings to receive frames are plumb, level, square, and in tolerance.

3.3 INSTALLATION
A. Install doors in accordance with manufacturer's instructions.
B. Install doors plumb, level, square, true to line, and without warp or rack.
C. Anchor frames securely in place.
D. Separate aluminum from other metal surfaces with bituminous coatings or other means approved by Architect.
E. Set thresholds in bed of mastic and backseal.
F. Install exterior doors to be weathertight in closed position.
G. Repair minor damages to finish in accordance with manufacturer's instructions and as approved by Architect.
H. Remove and replace damaged components that cannot be successfully repaired as determined by Architect.

3.4 FIELD QUALITY CONTROL
A. Manufacturer's Field Services: Manufacturer's representative shall provide technical assistance and guidance for installation of doors.

3.5 ADJUSTING
A. Adjust doors, hinges, and locksets for smooth operation without binding.

3.6 CLEANING
A. Clean doors promptly after installation in accordance with manufacturer’s instructions.
B. Do not use harsh cleaning materials or methods that would damage finish.

3.7 PROTECTION
A. Protect installed doors to ensure that, except for normal weathering, doors will be without damage or deterioration at time of substantial completion.

END OF SECTION
SECTION 08311
ACCESS DOORS AND FRAMES

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals: Product Data.

B. Fire-Rated Access Doors and Frames: Labeled by a testing and inspecting agency acceptable to authorities having jurisdiction based on testing per the following:
   1. Vertical Access Doors: NFPA 252 or UL 10B.
   2. Horizontal Access Doors and Frames: ASTM E 119 or UL 263.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Steel Sheets: ASTM A 1008/A 1008M or ASTM A 591/A 591M.

B. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, with A60 (ZF180) or G60 (Z180) coating.

C. Stainless-Steel Sheets: ASTM A 666, Type 304, with No. 4 directional satin finish.

2.2 ACCESS DOORS AND PANELS

A. Products:
   1. Acudor Products Inc.


C. Flush Access Doors and Trimless Frames: Stainless-steel units with drywall bead flange.

D. Recessed Access Doors and Trimless Frames: Stainless-steel units with drywall bead for gypsum board surfaces


H. Locks: Flush to finished surface, screwdriver operated.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install access doors and panels accurately in position. Adjust hardware and door and panels for proper operation.

B. Install fire-rated access doors and panels according to NFPA 80.

END OF SECTION
PART 1 - GENERAL

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

1.2 SUMMARY
A. Section Includes:
   1. Fire-rated counter doors.
B. Related Sections:
   1. Division 16 Sections for electrical service and connections for powered operators and accessories.

1.3 PERFORMANCE REQUIREMENTS
A. Delegated Design: Design overhead coiling doors, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
B. Operation Cycles: Provide overhead coiling door components and operators capable of operating for not less than number of cycles indicated for each door. One operation cycle is complete when a door is opened from the closed position to the fully open position and returned to the closed position.

1.4 SUBMITTALS
A. Product Data: For each type and size of overhead coiling door and accessory. Include the following:
   1. Construction details, material descriptions, dimensions of individual components, profiles for slats, and finishes.
   2. Rated capacities, operating characteristics, electrical characteristics, and furnished accessories.
   3. For fire-rated doors, description of fire-release system including testing and resetting instructions.
B. Shop Drawings: For each installation and for special components not dimensioned or detailed in manufacturer's product data. Include plans, elevations, sections, details, and attachments to other work.
1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
2. Show locations of replaceable fusible links.
3. Wiring Diagrams: For power, signal, and control wiring.

C. Samples for Initial Selection: Manufacturer's finish charts showing full range of colors and textures available for units with factory-applied finishes.
   1. Include similar Samples of accessories involving color selection.

D. Qualification Data: For qualified Installer.

E. Oversize Construction Certification: For door assemblies required to be fire-rated and that exceed size limitations of labeled assemblies.

F. Maintenance Data: For overhead coiling doors to include in maintenance manuals.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for both installation and maintenance of units required for this Project.

B. Source Limitations: Obtain overhead coiling doors from single source from single manufacturer.
   1. Obtain operators and controls from overhead coiling door manufacturer.

C. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at as close to neutral pressure as possible according to NFPA 252 or UL 10B.
   1. Oversize Fire-Rated Door Assemblies: For units exceeding sizes of tested assemblies, provide certification by a qualified testing agency that doors comply with standard construction requirements for tested and labeled fire-rated door assemblies except for size.
   2. Temperature-Rise Limit: Where indicated provide doors that have a maximum transmitted temperature end point of not more than 450 deg F (250 deg C) above ambient after 30 minutes of standard fire-test exposure.
   3. Smoke Control: In corridors and smoke barriers, provide doors that are listed and labeled with the letter “S” on the fire-rating label by a qualified testing agency for smoke- and draft-control based on testing according to UL 1784; with maximum air-leakage rate of 3.0 cfm/sq. ft. (0.01524 cu. m/s x sq. m) of door opening at 0.10 inch wg (24.9 Pa) for both ambient and elevated temperature tests.

D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

PART 2 - PRODUCTS

2.1 DOOR CURTAIN MATERIALS AND CONSTRUCTION

A. Door Curtains: Fabricate overhead coiling-door curtain of interlocking metal slats, designed to withstand wind loading indicated, in a continuous length for width of door without splices. Unless otherwise indicated, provide slats of thickness and mechanical properties recommended by door manufacturer for performance, size, and type of door indicated, and as follows:
   1. Stainless-Steel Door Curtain Slats: ASTM A 666, Type 304; sheet thickness of 0.025 inch (0.64 mm) and as required to meet requirements.
   2. Insulation: Fill slats for insulated doors with manufacturer's standard thermal insulation complying with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, according to ASTM E 84. Enclose insulation completely within slat faces.
   3. Metal Interior Curtain-Slat Facing: Match metal of exterior curtain-slat face.
   4. Gasket Seal: Provide insulated slats with manufacturer's standard interior-to-exterior thermal break or with continuous gaskets between slats.

B. Endlocks for Service Doors: Malleable-iron casings galvanized after fabrication, secured to curtain slats with galvanized rivets or high-strength nylon. Provide locks on not less than alternate curtain slats for curtain alignment and resistance against lateral movement.

C. Endlocks for Counter Doors: Manufacturer's standard locks on not less than alternate curtain slats for curtain alignment and resistance against lateral movement.

D. Bottom Bar for Service Doors: Consisting of two angles, each not less than 1-1/2 by 1-1/2 by 1/8 inch (38 by 38 by 3 mm) thick; fabricated from manufacturer's standard stainless steel, to match curtain slats and finish.

E. Bottom Bar for Counter Doors: Manufacturer's standard continuous channel or tubular shape, fabricated from manufacturer's standard, stainless steel, extrusions to match curtain slats and finish.

F. Curtain Jamb Guides: Manufacturer's standard angles or channels and angles of same material and finish as curtain slats unless otherwise indicated, with sufficient depth and strength to retain curtain, to allow curtain to operate smoothly, and to withstand loading. Slot bolt holes for guide adjustment. Provide removable stops on guides to prevent overtravel of curtain.

   1. Removable Posts and Jamb Guides for Counter Doors: Manufacturer's standard.
2.2 HOOD

A. General: Form sheet metal hood to entirely enclose coiled curtain and operating mechanism at opening head. Contour to fit end brackets to which hood is attached. Roll and reinforce top and bottom edges for stiffness. Form closed ends for surface-mounted hoods and fascia for any portion of between-jamb mounting that projects beyond wall face. Equip hood with intermediate support brackets as required to prevent sagging.
   1. Stainless Steel: 0.025-inch- (0.64-mm-) thick stainless-steel sheet, Type 304, complying with ASTM A 666.
   2. Include automatic drop baffle on fire-rated doors to guard against passage of smoke or flame.

2.3 COUNTER DOORS

A. Integral Frame, Hood, and Fascia for Counter Door: Welded sheet metal assembly of the following sheet metal:
   1. Stainless Steel: 0.062-inch- (1.59-mm-) thick stainless-steel sheet, Type 304, complying with ASTM A 666.

B. Integral Metal Sill for Counter Door: Fabricate sills as integral part of frame assembly of Type 304 stainless steel in manufacturer's standard thickness with No. 4 finish.

2.4 CURTAIN ACCESSORIES

A. Smoke Seals: Equip each fire-rated door with smoke-seal perimeter gaskets for smoke and draft control as required for door listing and labeling by a qualified testing agency.

B. Push/Pull Handles: Equip each push-up-operated or emergency-operated door with lifting handles on each side of door, finished to match door.
   1. Provide pull-down straps or pole hooks for doors more than 84 inches (2130 mm) high.

C. Automatic-Closing Device for Fire-Rated Doors: Equip each fire-rated door with an automatic-closing device that is inoperative during normal door operations and that has a governor unit complying with NFPA 80 and an easily tested and reset release mechanism designed to be activated by the following:
   1. Replaceable fusible links with temperature rise and melting point of 165 deg F (74 deg C) interconnected and mounted on both sides of door opening.
   2. Manufacturer's standard UL-labeled smoke detector and door-holder-release devices.
   3. Manufacturer's standard UL-labeled heat detector and door-holder-release devices.
2.5 COUNTERBALANCING MECHANISM

A. General: Counterbalance doors by means of manufacturer's standard mechanism with an adjustable-tension, steel helical torsion spring mounted around a steel shaft and contained in a spring barrel connected to top of curtain with barrel rings. Use grease-sealed bearings or self-lubricating graphite bearings for rotating members.

B. Counterbalance Barrel: Fabricate spring barrel of manufacturer's standard hot-formed, structural-quality, welded or seamless carbon-steel pipe, of sufficient diameter and wall thickness to support rolled-up curtain without distortion of slats and to limit barrel deflection to not more than 0.03 in./ft. (2.5 mm/m) of span under full load.

C. Spring Balance: One or more oil-tempered, heat-treated steel helical torsion springs. Size springs to counterbalance weight of curtain, with uniform adjustment accessible from outside barrel. Secure ends of springs to barrel and shaft with cast-steel barrel plugs.

D. Torsion Rod for Counterbalance Shaft: Fabricate of manufacturer's standard cold-rolled steel, sized to hold fixed spring ends and carry torsional load.

E. Brackets: Manufacturer's standard mounting brackets of either cast iron or cold-rolled steel plate.

2.6 MANUAL DOOR OPERATORS

A. Equip door with manufacturer's recommended manual door operator unless another type of door operator is indicated.

B. Push-up Door Operation: Design counterbalance mechanism so required lift or pull for door operation does not exceed 25 lbf (111 N).

C. Crank Operator: Consisting of crank and crank gearbox, steel crank drive shaft, and gear-reduction unit, of type indicated. Size gears to require not more than 25 lbf (111 N) force to turn crank. Fabricate gearbox to be oil tight and to completely enclose operating mechanism. Provide manufacturer's standard crank-locking device.

2.7 FIRE-RATED DOOR ASSEMBLY

A. Fire-Rated Counter Door: Overhead fire-rated coiling door formed with curtain of interlocking metal slats.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

   a. ACME Rolling Doors.
   b. Alpine Overhead Doors, Inc.
   c. AlumaTek, Inc.
d. C.H.I. Overhead Doors.
e. City-Gates.
f. Cookson Company.
g. Cornell Iron Works, Inc.
h. Lawrence Roll-Up Doors, Inc.
i. Mahon Door Corporation.
j. McKeon Rolling Steel Door Company, Inc.
k. Overhead Door Corporation.
l. Raynor.
m. Southwestern Steel Rolling Door Co.
n. Wayne-Dalton Corp.
o. Windsor Door.
p.

B. Operation Cycles: Not less than 10,000
   1. Include tamperproof cycle counter.

C. Fire Rating: 3/4 hour with temperature-rise limit and with smoke control.

D. Door Curtain Material: Stainless steel.

E. Door Curtain Slats: Flat profile slats of 1-1/2-inch (38-mm) center-to-center height.
   1. Insulated-Slat Interior Facing: Metal.

F. Curtain Jamb Guides: Stainless steel with exposed finish matching curtain slats.

G. Hood: Stainless steel.
   1. Shape: Square
   2. Mounting: Face of wall

H. Integral Frame, Hood, and Fascia for Counter Door: Stainless steel.
   1. Mounting: Face of wall.

I. Sill Configuration for Fire-Rated Counter Door: Integral metal sill

   1. Provide operator with manufacturer's standard removable operating arm.

K. Door Finish:
   1. Stainless-Steel Finish: No. 4 (polished directional satin).
   2. Interior Curtain-Slat Facing: Match finish of exterior curtain-slat face.

2.8 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.9 STAINLESS-STEEL FINISHES

A. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.

B. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.

1. Run grain of directional finishes with long dimension of each piece.
2. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.
3. Directional Satin Finish: No. 4.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates areas and conditions, with Installer present, for compliance with requirements for substrate construction and other conditions affecting performance of the Work.

B. Examine locations of electrical connections.

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

3.2 INSTALLATION

A. Install overhead coiling doors and operating equipment complete with necessary hardware, anchors, inserts, hangers, and equipment supports; according to manufacturer's written instructions and as specified.

B. Install overhead coiling doors, hoods, and operators at the mounting locations indicated for each door.

C. Accessibility: Install overhead coiling doors, switches, and controls along accessible routes in compliance with regulatory requirements for accessibility.

D. Fire-Rated Doors: Install according to NFPA 80.

E. Smoke-Control Doors: Install according to NFPA 80 and NFPA 105.

3.3 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.
1. Perform installation and startup checks according to manufacturer’s written instructions.
2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
3. Test door closing when activated by detector or alarm-connected fire-release system. Reset door-closing mechanism after successful test.

3.4 ADJUSTING

A. Adjust hardware and moving parts to function smoothly so that doors operate easily, free of warp, twist, or distortion.

B. Lubricate bearings and sliding parts as recommended by manufacturer.

C.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain overhead coiling doors.

END OF SECTION
SECTION 08332

OVERHEAD COILING DOORS

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals: Product Data and Shop Drawings.

PART 2 - PRODUCTS

2.1 OVERHEAD COILING DOORS

A. Available Products:

1. Alpine Overhead Doors, Inc.

B. Fire-Rated Doors: Labeled by a testing and inspecting agency acceptable to authorities having jurisdiction based on testing at as close to neutral pressure as possible according to NFPA 252 or UL 10B.

1. For units exceeding sizes of tested assemblies, provide certification by a qualified testing agency that doors comply with standard construction requirements for tested and labeled fire-rated door assemblies except for size.

C. Structural Performance, Exterior Doors: Provide doors capable of meeting the Florida Building Code for wind loads and large missile impact loads.

D. Door Curtain Slats: Stainless-steel w/ color powder coat finish, flat-profile, acoustical insulated slats. Color to be selected. Slats to be painted at interior and exterior surfaces.

E. Operation: Electrical with galvanized chain manual auxiliary hoist. Operator to include in-line gear reducer, solenoid actuated brake and be designed for high cycle usage up to 40 cycles per hour. Provide adjustable limit switches.

F. Obstruction Detection Device: Equip motorized door with external automatic safety sensor capable of protecting full width of door opening. Activation of device immediately stops and reverses downward door travel.

G. Tracks, Supports, and Hardware: Type 316 Stainless Steel.

H. Weatherseals: Provide replaceable weather stripping at bottom and at top of exterior doors.

I. Guides and Hood Cover: 316 stainless steel. Hood to be powder coated, color to be selected.
J. Acoustical Insulation: IPB-S by Alpine to provide a STC rating of 30.

K. Electric Motor: Provide heavy duty TEFC motor and gearbox. 208V., 1 Phase Power with overload protection and 3-button, open-close-stop wall mount control station.

L. Doors to have tension spring counter-balance assembly.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install door, track, and operating equipment complete with necessary hardware, jamb and head mold strips, anchors, inserts, hangers, and equipment supports.

B. Accessibility: Install overhead coiling doors, switches, and controls along accessible routes in compliance with regulatory requirements for accessibility.

C. Test and adjust controls and safety devices.

END OF SECTION
SECTION 08567
SOUND CONTROL WINDOWS

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 sound control windows with STC ratings of 49.

1.3 SUBMITTALS
   A. Product Data: Submit manufacturer's product data and installation instructions.
   B. Test Reports: Upon request submit certified test reports from recognized test laboratories.
   C. Certificates: Submit manufacturer's certificate that products meet or exceed specified requirements.

1.4 DELIVERY, STORAGE & HANDLING
   A. Delivery: Deliver material in the manufacturer's original, unopened, undamaged containers with identification labels intact.
   B. Provide labels indicating brand name, source of procurement, style, size and thickness.
   C. Storage and Protection: Store materials protected from exposure to harmful environmental conditions and at temperature and humidity conditions recommended by the manufacturer.

1.5 WARRANTY
   A. Warranty Period: Two years.

PART 2 - PRODUCTS

2.1 MANUFACTURERS
   A. Sound Control Windows:
   a. 123 Columbia Court North Suite 210.
   b. Chaska, MN  55318.
   c. (800) 448 - 0121.
   d. www.AcousticalSurfaces.com

2. Or approved equal.

2.2 SOUND CONTROL WINDOWS

A. Product: Model Studio 5.
   1. STC rating: 49.
   2. Flat glass configuration.
   3. Size (clear opening): As indicated on Drawing.
   4. Glazing: 3/8" laminated glass with air cavity and 1/4" laminated glass.
   5. Frame: 4-1/2" anodized aluminum frame.

B. Window Frame:
   1. Anodized aluminum.
      a. Finish: Clear.
   2. Acoustically treated frames and seals.
   3. Class A-1 ASTM E-84 Nonflammable Sound Silencer™ acoustical frame insert.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine openings, substrates, anchorage, and conditions.

B. Immediately inspect shipment for damage during transit i.e., damage caused by fork lifts, stacking, water stains etc. and disclose to delivery driver prior to signing for receipt.

3.2 INSTALLATION

A. Manufacturer's Instructions:
   1. Comply with the instructions and recommendations of the window manufacturer.

3.3 CLEANING

A. Clean aluminum surfaces immediately after installing windows. Avoid damaging protective coatings and finishes. Remove excess sealants, glazing materials, dirt, and other substances.

END OF SECTION
SECTION 08710

DOOR HARDWARE

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Application provisions of the general conditions are a part of this section.

B. Work covered by this Section of Specifications consists of furnishing and delivering to the jobsite for fitting and installation, all Finish Hardware complete, in accordance with this Section and applicable drawings and subject to terms and conditions of Contract. 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 Engineer’s attention during the bidding period.

1.02 ITEMS SPECIFIED IN OTHER SECTIONS

A. Finish Hardware shall be installed as specified in the Section “Carpentry and Millwork.”

B. Hardware for the following items are specified as a part of the items in their respective sections.

1. Sash
2. Toilet Partitions and Accessories (except stops where indicated)
3. Cabinet and Casework
4. Overhead Doors
5. Folding Doors
6. Rough and Constructional
7. Aluminum Door Hardware except Cylinders

1.03 SUPPLIER

A. Finish Hardware shall be furnished by one approved by the Engineer as having appropriate technical knowledge and experience to correctly interpret drawings and specifications. Supplier shall be prepared at all times during progress of 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. Supplier shall be bona-fide direct distributor of all material furnished.

1.04 TYPE AND QUALITY

A. For purposes of designating type and quality of work of this Section, specifications are based on products of companies named. Products of other manufacturers may be approved if submitted for consideration, ten days prior to bid date, and approved by Addendum.
1.05 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.

1.06 INSTALLATION

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. This supplier shall furnish Hardware Schedule as approved by the Engineer and all necessary templates to metal door and frame fabricators for their coordinations use.

1.07 SCHEDULES

A. Submit 6 complete typewritten Hardware Schedules to the Engineer 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 Engineer.

B. Two current copies of catalog cuts shall be submitted with the Hardware Schedule for each item of the 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.

1.08 RESPONSIBILITY

A. It shall be the supplier’s responsibility to furnish Hardware in accordance with the intent of this Specification. Where, by virtue of Architectural design or by function, a change is necessary, Hardware of equal design and quality shall be furnished upon written approval of the Engineer. All Hardware shall meet the requirements of applicable codes. i.e. Underwriters Laboratory, Americans with Disabilities Act Title III.

1.09 LOCATIONS

A. Hardware locations dimension shall be as follows:

Distance from finish floor to center line of:
- Door Knob: 38"
- Door Pull: 42"
- Deadlock: 45"
- Exit Bolt Cross Bar: 38"
- Push Plate: 50"
- Butt Hinges: Bottom Hinge - Finish floor to bottom of hinge 10".
  Top hinge head rabbet to top of hinge 5". Center
hinge - equal distance between top and bottom hinges.

1.10 180 DEGREE OPENINGS

A. Other than those doors that are restricted to less than 180 degree opening by building or by overhead holders or stops, all butts and/or closer arms shall be of sufficient size to allow full 180 degree opening of doors.

PART 2 - PRODUCTS

2.01 BUTT HINGES

A. Doors 1-3/4" over 3’ 6” and designated high frequency (see Door Schedule) extra heavy weight (4) ball bearing 5” x 4-1/2”.

B. Doors 1-3/4” thick - minimum 4-1/2” high.

C. Doors 1-3/8” thick - minimum 3-1/2” high.

D. Each door shall have not less than three hinges. Doors 7’ 6” and higher shall have four hinges whether specified under items or not.

E. All exterior outswinging doors to have non-removable pins except where modified in the Hardware Schedule.

F. All butts used with door closers shall be ball bearing. All exterior doors shall have ball bearing butts, except as otherwise specified.

G. Approved manufacturers are Hager, McKinney, and Stanley.

2.02 LOCKSETS/DEADLOCKS

A. Shall be the following manufacturer and shall be furnished in the function as specified in the Hardware Sets. No substitution permitted.

<table>
<thead>
<tr>
<th>Manufacturer</th>
<th>Design</th>
<th>Series</th>
</tr>
</thead>
<tbody>
<tr>
<td>Schlage</td>
<td>Rhodes</td>
<td>ND</td>
</tr>
<tr>
<td>Best</td>
<td>15D</td>
<td>9K</td>
</tr>
<tr>
<td>Hager</td>
<td>Withnell</td>
<td>3400</td>
</tr>
<tr>
<td>Sargent</td>
<td>LL</td>
<td>10 Line</td>
</tr>
</tbody>
</table>

B. All levers, escutcheons, locksets, and cylinders shall be the product of the manufacturer.

C. Lockset latchbolt throw 1/2”.

2.03 EXIT DEVICES
A. All devices shall be rim or vertical rod in type and function as specified. Devices must be listed under “Panic Hardware” in accident equipment of Underwriters Laboratories. All labeled doors with “Fire Hardware” must have labels attached and be in strict accordance with Underwriters Laboratories. Pulls and dummy trim shall be lever type.

<table>
<thead>
<tr>
<th>Manufacturer</th>
<th>Series</th>
</tr>
</thead>
<tbody>
<tr>
<td>Von Duprin</td>
<td>99 Series</td>
</tr>
<tr>
<td>Stanley / Precision</td>
<td>Apex Series</td>
</tr>
<tr>
<td>Hager</td>
<td>4500 Series</td>
</tr>
<tr>
<td>Sargent</td>
<td>8000 Series</td>
</tr>
</tbody>
</table>

2.04 DOOR CLOSERS

A. Closers shall be one of the following manufacturers or approved equal and shall be furnished in the manufacturer’s recommended printed size for the specified condition 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.

<table>
<thead>
<tr>
<th>Manufacturer</th>
<th>Series</th>
</tr>
</thead>
<tbody>
<tr>
<td>LCN</td>
<td>4041</td>
</tr>
<tr>
<td>Stanley</td>
<td>D-4550</td>
</tr>
<tr>
<td>Hager</td>
<td>5100</td>
</tr>
<tr>
<td>Sargent</td>
<td>351</td>
</tr>
</tbody>
</table>

B. Furnish door closers with proper arms and/or brackets to avoid conflict with door lites and/or low ceiling reveals.

2.05 DOOR TRIM

A. All push plates, pulls, pull plates, kick plates and/or armor plates shall be any one of the following manufacturer’s products or approved equal in catalog number as set forth herein.

<table>
<thead>
<tr>
<th>Manufacturer</th>
<th>Push Plate</th>
<th>Pull Plate</th>
<th>Kick Plate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rockwood</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Trimco</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hager</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

B. Wrought plate material shall be minimum .050 thick.

2.06 SILENCERS

A. All interior wood and metal door frames shall have door silencers Type 64 or 65, three per single door, two per pair of doors.
2.07 STOPS, HOLDERS, AND LOCK GUARDS

A. Stops shall be of the following manufacturers or approved equal:

Manufacturer
Rockwood
Hager
Trimco

2.08 THRESHOLDS & DOOR STRIPPING PRODUCTS

A. Thresholds shall be of the following manufacturer's or approved equal. See Hardware Schedule for types required.

Unger Technologies
Hager
National Guard Products, Inc.
Pemko Manufacturing Co.

2.09 KEYING

A. All locks and cylinders to be keyed construction keyed. Keying meeting will be required to establish owners permanent keying requirements.

2.10 FASTENINGS

A. All screws shall be of matching finish to their product and shall be the manufacturer’s standard for that item.

B. Sex Bolts - Door closers, door holders, and exit devices installed on wood doors shall be attached by means of the bolts and sex nuts.

2.11 FINISHES

A. Butts - Exterior
   US32D  630
B. Butts - Interior
   US32D  630
C. Locks
   US26D  626
D. Push, Pulls, Kickplates, Lock Guards
   US32D  630
E. Closers
   Sprayed Aluminum  689
F. Door Stops & Miscellaneous
   US32D/US26D  630/626
G. Exit Devices
   US32D/US26D  630/626
PART 3 - SCHEDULE

A. The following Schedule is furnished for whatever assistance it may afford the Contractor; Do not consider it as entirely inclusive. Should any particular door or item be omitted in any scheduled hardware group, provide door or item with hardware same as required for similar purposes. Quantities listed are for each pair of doors; or for each single door.

B. The Hardware Schedule prepared by and Hardware can be purchased through:

Fields Door & Hardware, Inc.
1497-1 Rail Head Boulevard
Naples, Fl 34110

Phone: (239) 598-1010
Fax: (239) 591-1233

Port of the Islands – Water Treatment Plant

SCHEDULE

HW-1

Dr. 101, 104, 119, 121

NOTE: All Hardware by Door Supplier

HW-2

Dr. 102, 120, 118, 117, 114, 109, 105
Each to have:

3ea. HAG Hinges BB1191 NRP
1ea. VON Exit Device 99L x 996L
1ea. SCH Cylinder As Required for Exit Device
1ea. LCN Door Closer 4041 S-CUSH
1ea. ROC Kickplate 10” x 2” LWOD
1ea. UNG Threshold 566-LAR (Length as Required)
1ea. UNG Auto. Dr. Bottom 365-LAR
1ea. UNG Seal 475-LAR
1ea. UNG Seal 119W-LAR

HW-3

Dr. 103, 116, 115, 113
Each to have:

3ea. HAG Hinges BB1191
1ea. VON Exit Device 99L-F x 996L
1ea. SCH Cylinder As Required for Exit Device
1ea. LCN Door Closer 4041 S-CUSH
1ea. ROC Kickplate 10” x 2” LWOD
1ea. UNG Threshold 566-LAR
1ea. UNG Auto. Dr. Bottom 365-LAR
1ea. UNG Seal 475-LAR
1ea. UNG Seal 119W-LAR

**HW-4**

Dr. 106
Each to have:

6ea. HAG Hinges BB1191 NRP
2ea. VON Exit Device 9957L x 996L
1ea. VON Mullion 9954-LAR
2ea. SCH Cylinder As Required for Exit Device
2ea. LCN Door Closer 4041 S-CUSH
2ea. ROC Kickplate 10” x 2” LWOD
1ea. UNG Threshold 566-LAR
1ea. UNG Auto. Dr. Bottom 365-LAR
1ea. UNG Seal 475-LAR
1ea. UNG Seal 119W-LAR

**HW-5**

Dr. 107
Each to have:

3ea. HAG Hinges BB1191
1ea. SCH Passage ND10S
1ea. LCN Door Closer 4041 S-CUSH
1ea. ROC Kickplate 10” x 2” LWOD
1ea. UNG Threshold 566-LAR
1ea. UNG Auto. Dr. Bottom 365-LAR
1ea. UNG Seal 475-LAR
1ea. UNG Seal 119W-LAR

**HW-6**

Dr. 108, 112
Each to have:

3ea. HAG Hinges BB1191
1ea. SCH Passage ND10S
1ea. LCN Door Closer 4041
1ea. ROC Wall Stop 409
1ea. ROC Kickplate 10” x 2” LWOD
1ea. UNG Threshold 566-LAR
1ea. UNG Auto. Dr. Bottom 365-LAR
1ea. UNG Seal 475-LAR
1ea. UNG Seal 119W-LAR
HW-7

Dr. 110, 111
Each to have:

<table>
<thead>
<tr>
<th>Quantity</th>
<th>Brand</th>
<th>Description</th>
<th>Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>3ea.</td>
<td>HAG</td>
<td>Hinges</td>
<td>BB1191</td>
</tr>
<tr>
<td>1ea.</td>
<td>SCH</td>
<td>Privacy</td>
<td>ND40S</td>
</tr>
<tr>
<td>1ea.</td>
<td>LCN</td>
<td>Door Closer</td>
<td>4041</td>
</tr>
<tr>
<td>1ea.</td>
<td>ROC</td>
<td>Wall Stop</td>
<td>409</td>
</tr>
<tr>
<td>1ea.</td>
<td>UNG</td>
<td>Threshold</td>
<td>566-LAR</td>
</tr>
<tr>
<td>1ea.</td>
<td>UNG</td>
<td>Auto. Dr. Bottom</td>
<td>365-LAR</td>
</tr>
<tr>
<td>1ea.</td>
<td>UNG</td>
<td>Seal</td>
<td>475-LAR</td>
</tr>
<tr>
<td>1ea.</td>
<td>UNG</td>
<td>Seal</td>
<td>119W-LAR</td>
</tr>
</tbody>
</table>

END OF SECTION
PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals: Product Data

B. Glazing Publications: Comply with the following published recommendations:
   1. GANA's "Glazing Manual" unless more stringent requirements are indicated. Refer to this publication for definitions of glass and glazing terms not otherwise defined in this Section or in referenced standards.
   2. GANA Mirror Division's "Mirrors, Handle with Extreme Care: Tips for the Professional on the Care and Handling of Mirrors."

C. Safety Glazing Products: For tempered mirrors, provide products complying with testing requirements in 16 CFR 1201 for Category II materials.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Glass Mirrors, General: ASTM C 1503; manufactured using copper-free, low-lead mirror coating process.

B. Tempered Clear Glass: Mirror Glazing Quality, for blemish requirements; and comply with ASTM C 1048 for Kind FT, Condition A, tempered float glass before silver coating is applied; 5.0-mm nominal thickness.

C. Mirror Mastic: An adhesive setting compound, asbestos free, produced specifically for setting mirrors and certified by both mirror manufacturer and mastic manufacturer as compatible with glass coating and substrates on which mirrors will be installed.

D. Film Backing for Safety Mirrors: Film backing and pressure-sensitive adhesive; both compatible with mirror backing paint as certified by mirror manufacturer.

E. Film Backing for Safety Mirrors: Film backing and pressure-sensitive adhesive; both compatible with mirror backing paint as certified by mirror manufacturer.

F. Aluminum J-Channels: Aluminum extrusions with a return deep enough to produce a glazing channel to accommodate mirrors of thickness indicated and in lengths required to cover edges of each mirror in a single piece.
   1. Finish: Clear bright anodized.
2.2 FABRICATION

A. Mirror Edge Treatment: Flat polished.
   1. Seal edges of mirrors with edge sealer after edge treatment to prevent chemical or atmospheric penetration of glass coating.

B. Film-Backed Safety Mirrors: Apply film backing with adhesive coating over mirror backing paint as recommended in writing by film-backing manufacturer.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Provide a minimum air space of 1/8 inch (3 mm) between back of mirrors and mounting surface for air circulation between back of mirrors and face of mounting surface.

B. Wall-Mounted Mirrors: Install mirrors with mastic and mirror hardware. Attach mirror hardware securely to mounting surfaces with mechanical fasteners installed so heads do not impose point loads on backs of mirrors.
   1. Top and Bottom Aluminum J-Channels: Provide setting blocks 1/8 inch (3 mm) thick by 4 inches (100 mm) long at quarter points.
   2. Mirror Clips: Place a felt or plastic pad between mirror and each clip. Locate clips so they are symmetrically placed and evenly spaced.
   3. Apply mastic to comply with mastic manufacturer's written instructions for coverage and to allow air circulation between back of mirrors and face of mounting surface.

C. Remove nonpermanent labels, and clean surfaces immediately after installation.

END OF SECTION
SECTION 08900
LOUVERS AND VENTS

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Provide louvers complying with performance requirements indicated as demonstrated by testing according to AMCA 500-L.

B. Submittals: Product Data.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Aluminum Extrusions: ASTM B 221 (ASTM B 221M), Alloy 6063-T5, T-52, or T6.

B. Stainless-Steel Sheet: ASTM A 240/A 240M, Type 304.

C. Fasteners: Type 316 stainless steel.

2.2 LOUVERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide product(s) named in subparagraph(s) below or comparable product by one of the following:

1. Ruskin.

B. Horizontal Extruded-Aluminum, Storm-Resistant Louvers:

1. Available Products:
   a. Ruskin.

2. Louver Depth: 5 inches (125 mm).

3. Aluminum Thickness: 0.060 inch (1.5 mm) for blades and 0.080 inch (2.0 mm) for frames.

4. Free Area: Not less than 7.0 sq. ft. (0.65 sq. m)] for 48-inch- (1.2-m-) wide by 48-inch- (1.2-m-) high louver.

5. Air Performance: Not more than 0.10-inch wg (25-Pa) static pressure drop at 500-fpm free-area intake velocity.

6. Wind-Driven Rain Performance: Not less than 95 percent effectiveness when subjected to a rain fall rate of 8 inches (200 mm) per hour and a wind speed of 50 mph (22.4 m/s) at a core area intake velocity of 400 fpm.
2.3 LOUVER SCREENS

A. Provide screen at interior face of each exterior louver. Fabricate screen frames from same kind and form of metal as indicated for louver to which screens are attached.

1. Screening: Stainless-steel, 1/2-inch- (12.7-mm-) square mesh.
2. Screening: Flattened, expanded aluminum, 3/4 by 0.050 inch (19 by 1.27 mm) thick.
3. Finish: Mill.

2.4 LOUVER FINISHES

A. Aluminum Louvers: Conversion-coated and factory-primed finish, AA-C12C42R1x.

B. Aluminum Louvers: Color anodic finish, AAMA 611, [AA-M12C22A42/A44, Class I, 0.018 mm or thicker.


C. Aluminum Louvers: High-performance organic coating; AA-C12C42R1x; two-coat fluoropolymer system complying with AAMA 2604, with finish coats containing at least 70 percent PVDF resin by weight.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install louvers level, plumb, and at indicated alignment with adjacent work.

B. Provide perimeter reveals of uniform width for sealants and joint fillers, as indicated.

C. Use concealed anchorages where possible.

D. Protect metal surfaces from corrosion or galvanic action by applying a heavy coating of bituminous paint on surfaces that will be in contact with concrete, masonry, or dissimilar metals.

END OF SECTION
SECTION 09221
NON-STRUCTURAL METAL FRAMING

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals: Product Data.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Resistance-Rated Assemblies: Provide materials and construction identical to those tested in assemblies per ASTM E 119 by an independent testing and inspecting agency acceptable to authorities having jurisdiction.

B. STC-Rated Assemblies: Provide materials and construction identical to those tested in assemblies per ASTM E 90 and classified per ASTM E 413 by a qualified independent testing and inspecting agency.

2.2 METAL FRAMING AND SUPPORTS

A. Steel Framing Members, General: ASTM C 754.

1. Steel Sheet Components: ASTM C 645. Thickness specified is minimum uncoated base-metal thickness.

B. Suspended Ceiling and Soffit Framing:

1. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.0625-inch (1.59-mm) diameter, or double strand of 0.0475-inch (1.21-mm-) diameter wire.
2. Wire Hangers: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, and 0.162-inch (4.12-mm) diameter.
3. Carrying Channels: Cold-rolled galvanized steel, 0.0538 inch (1.37 mm) thick, 2-1/2 inches (63.5 mm) deep.
4. Furring Channels: 7/8 inch (22.2 mm) deep, 0.0179 inch (0.454 mm) thick galvanized steel, rigid hat-shaped channels; 7/8 inch (22.2 mm) deep, 0.0296 inch (0.752 mm) thick
5. Grid Suspension System for Interior Ceilings: Interlocking, direct-hung system.

C. Partition and Soffit Framing:

1. Studs and Runners: In depth indicated and [0.0179 inch (0.454 mm)] [0.0296 inch (0.752 mm)] thick unless otherwise indicated.
2. Flat Strap and Backing: 0.0179 inch (0.454 mm) thick.
3. Rigid Hat-Shaped Furring Channels: In depth indicated and 0.0179 inch (0.454 mm) thick.
4. Cold-Rolled Furring Channels: 0.0538 inch (1.37 mm) thick, 3/4 inch (19.1 mm) deep.
5. Z-Furring: In depth required by insulation, 1-1/4-inch (31.8-mm) face flange, 7/8-inch (22.2-mm) wall-attachment flange, and 0.0179 inch (0.454 mm) thick.

2.3 ACCESSORIES

A. General: Comply with referenced installation standards.

1. Fasteners for Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.


PART 3 - EXECUTION

3.1 INSTALLATION

A. Install steel framing to comply with ASTM C 754 and with ASTM C 840 requirements that apply to framing installation and with United States Gypsum's "Gypsum Construction Handbook."

1. Gypsum Plaster Assemblies: Also comply with ASTM C 841.
2. Portland Cement Plaster Assemblies: Also comply with ASTM C 1063.

B. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.

C. Isolate steel framing from building structure, except at floor, to prevent transfer of loading imposed by structural movement.

1. Where studs are installed directly against exterior walls, install asphalt-felt or foam-gasket isolation strip between studs and wall.

D. Fire-Resistance-Rated Assemblies: Comply with requirements of listed assemblies.

END OF SECTION
PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals: Product Data. Location in U.S. where products are manufactured.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Resistance-Rated Assemblies: Provide materials and construction identical to those tested in assemblies per ASTM E 119 by an independent testing and inspecting agency acceptable to authorities having jurisdiction.

B. STC-Rated Assemblies: Provide materials and construction identical to those tested in assemblies per ASTM E 90 and classified per ASTM E 413 by a qualified independent testing and inspecting agency.

2.2 PANEL PRODUCTS

A. Provide in maximum lengths available to minimize end-to-end butt joints.

B. All gypsum products are to be manufactured in the United States.

C. Interior Gypsum Board: ASTM C 36/C 36M or ASTM C 1396/C 1396M, in thickness indicated, with manufacturer’s standard edges. Regular type unless otherwise indicated, Type X where indicated, Sag-resistant type for ceiling surfaces.

D. Water-Resistant Gypsum Backing Board: ASTM C 630/C 630M or ASTM C 1396/C 1396M, in thickness indicated. Regular type unless otherwise indicated, Type X where required for fire-resistance-rated assemblies and where indicated.

E. Glass-Mat, Water-Resistant Gypsum Backing Board: ASTM C 1178/C 1178M, of thickness indicated. Regular type unless otherwise indicated, Type X where required for fire-resistance-rated assemblies and where indicated.

1. Product: G-P Gypsum; Dens-Shield Tile Guard.

F. Cementitious Backer Units: ANSI A118.9.
2.3 ACCESSORIES

A. Trim Accessories: ASTM C 1047, formed from galvanized or aluminum-coated steel sheet, rolled zinc, plastic, or paper-faced galvanized-steel sheet. For exterior trim, use accessories formed from hot-dip galvanized-steel sheet, plastic, or rolled zinc.

1. Provide cornerbead at outside corners unless otherwise indicated.
2. Provide LC-bead (J-bead) at exposed panel edges.
3. Provide control joints where indicated.

B. Aluminum Accessories: Extruded-aluminum accessories indicated with manufacturer’s standard corrosion-resistant primer Joint-Treatment Materials: ASTM C 475/C 475M.

1. Joint Tape: Paper unless otherwise recommended by panel manufacturer.
2. Joint Compounds: Setting-type taping compound and drying-type, ready-mixed, compounds for topping
3. Cementitious Backer Unit Joint-Treatment Materials: Products recommended by cementitious backer unit manufacturer.


D. Sound-Attenuation Blankets: ASTM C 665, Type I (unfaced).

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install gypsum board to comply with ASTM C 840.

1. Isolate gypsum board assemblies from abutting structural and masonry work. Provide edge trim and acoustical sealant.
3. Multilayer Fastening Methods: Fasten base layers and face layer separately to supports with screws.

B. Install cementitious backer units to comply with ANSI A108.11.

C. Fire-Resistance-Rated Assemblies: Comply with requirements of listed assemblies.

D. Finishing Gypsum Board: ASTM C 840.

1. At concealed areas, unless a higher level of finish is required for fire-resistance-rated assemblies, provide Level 1 finish: Embed tape at joints.
2. At substrates for tile, provide Level 2 finish: Embed tape and apply separate first coat of joint compound to tape, fasteners, and trim flanges.
3. Unless otherwise indicated, provide Level 4 finish: Embed tape and apply separate first, fill, and finish coats of joint compound to tape, fasteners, and trim flanges.

E. Glass-Mat, Water-Resistant Backing Panels: Finish according to manufacturer's written instructions.

F. Cementitious Backer Units: Finish according to manufacturer's written instructions.

END OF SECTION
SECTION 09511
ACOUSTICAL PANEL CEILINGS

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals: Product Data and material Samples.

B. Extra Materials: Deliver to Owner 12 extra ceiling panels for storage.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Resistance-Rated Assemblies: Provide materials and construction identical to those tested in assemblies per ASTM E 119 by an independent testing and inspecting agency acceptable to authorities having jurisdiction.

B. Seismic Standard: Provide acoustical panel ceilings designed and installed to withstand the effects of earthquake motions according to the following:

   2. UBC Standard 25-2, "Metal Suspension Systems for Acoustical Tile and for Lay-in Panel Ceilings."

2.2 ACOUSTICAL PANELS

A. Available Products:

   1. Armstrong; Cirrus

B. Classification: As follows, per ASTM E 1264:

   1. Type and Form: Type III, Form 1.
   2. Pattern: E (lightly textured)
   4. Light Reflectance (LR) Coefficient: Not less than 0.86.
   5. Noise Reduction Coefficient (NRC): Not less than 0.70.

C. Surface-Burning Characteristics: ASTM E 1264, Class A materials, tested per ASTM E 84.

D. Edge Detail: Reveal sized to fit exposed flange of suspension system.
E. Thickness: 3/4 inch (19 mm).

F. Modular Size: 24 by 24 inches (610 by 610 mm).

2.3 CEILING SUSPENSION SYSTEM

A. Wide-face, direct-hung system; ASTM C 635, intermediate-duty structural classification.

   1. Available Products:

      a. Armstrong; AL Prelude Plus XL 15/16”


B. Attachment Devices: Sized for 5 times the design load indicated in ASTM C 635, Table 1, Direct Hung, unless otherwise indicated.

C. Wire Hangers, Braces, and Ties: Zinc-coated carbon-steel wire; ASTM A 641/A 641M, Class 1 zinc coating, soft temper.

   1. Size: Provide yield strength at least 3 times the hanger design load (ASTM C 635, Table 1, Direct Hung), but not less than 0.106-inch- (2.69-mm-) diameter wire.

D. Hold-Down Clips: Manufacturer's standard product; spaced 24 inches (610 mm) o.c. on all cross tees.

PART 3 - EXECUTION

3.1 INSTALLATION


   1. Fire-Rated Assembly: Install fire-rated ceiling systems according to tested fire-rated design.

B. Install acoustical panels with undamaged edges and fit accurately into suspension system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide a neat, precise fit.

   C. Arrange directionally patterned acoustical panels as indicated on Drawings.

END OF SECTION
PART 1 - GENERAL

1.1 SECTION REQUIREMENTS
   A. Submittals: Product Data and Samples.

PART 2 - PRODUCTS

2.1 RESILIENT BASE
   A. Available Products:
      1. Roppe
   B. Color and Pattern: To be selected.
   C. ASTM F 1861, Type TS (rubber, vulcanized thermoset).
   E. Style: Cove (base with toe).
   F. Minimum Thickness: 0.125 inch (3.2 mm).
   G. Height: 4 inches (102 mm).
   H. Lengths: Coils in manufacturer’s standard lengths.
   I. Outside Corners: preformed.
   J. Inside Corners: preformed.
   K. Finish: As selected.

2.2 RESILIENT MOLDING ACCESSORY
   A. Available Products:
      1. Roppe
   B. Color: As selected.
   C. Description: Edge transition strip centered under doors between epoxy and VCT flooring.
2.3 INSTALLATION ACCESSORIES

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement- or blended hydraulic cement-based formulation provided or approved by flooring manufacturer for applications indicated.

B. Adhesives: Water-resistant type recommended by manufacturer to suit products and substrate conditions.

C. Metal Edge Strips: Extruded aluminum with mill finish of width shown, of height required to protect exposed edges of tiles, and in maximum available lengths to minimize running joints.

D. Floor Polish: Provide protective liquid floor polish products as recommended by resilient stair tread manufacturer.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Prepare concrete substrates according to ASTM F 710. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.

B. Adhesively install resilient wall base and accessories.

C. Install wall base in maximum lengths possible. Apply to walls, columns, pilasters, casework, and other permanent fixtures in rooms or areas where base is required.

D. Install reducer strips at edges of floor coverings that would otherwise be exposed.

E. Floor Polish: Remove soil, visible adhesive, and surface blemishes before applying liquid floor polish.
   1. Apply two coats.

END OF SECTION
SECTION 09652
RESILIENT TILE FLOORING

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals: Product Data and Samples.

B. Extra Materials: Deliver to Owner two boxes for every 20 boxes or fraction thereof, of each type and color of resilient floor tile installed.

PART 2 - PRODUCTS

2.1 VINYL COMPOSITION FLOOR TILE

A. Available Products:

1. Armstrong

B. Color and Pattern: Excelon, Stonetex

C. ASTM F 1066, Class 2 (through-pattern tile).

D. Fire-Test Response: Critical radiant flux classification of Class I, not less than 0.45 W/sq. cm per ASTM E 648.

E. Wearing Surface: Smooth.

F. Thickness: 0.125 inch (3.2 mm).

G. Size: 12 by 12 inches (304.8 by 304.8 mm).

2.2 INSTALLATION ACCESSORIES

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement- or blended hydraulic cement-based formulation provided or approved by flooring manufacturer for applications indicated.

B. Adhesives: Water-resistant type recommended by manufacturer to suit resilient products and substrate conditions indicated.

C. Floor Polish: Protective liquid floor polish products as recommended by manufacturer.
PART 3 - EXECUTION

3.1 INSTALLATION

A. Prepare concrete substrates according to ASTM F 710. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.

B. Lay out tiles so tile widths at opposite edges of room are equal and are at least one-half of a tile.

C. Match tiles for color and pattern by selecting tiles from cartons in same sequence as manufactured and packaged. Lay tiles with grain running in one direction.

D. Floor Polish: Remove soil, visible adhesive, and surface blemishes from floor tile surfaces before applying liquid floor polish.

   1. Apply two coat(s).

END OF SECTION
SECTION 09910
PAINTING

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals:
   1. Product Data.
   2. Samples.

B. Mockups: Full-coat finish Sample of each type of coating, color, and substrate, applied where directed.

C. Extra Materials: Deliver to Owner 1 gal. of each color and type of finish coat paint used on Project, in containers, properly labeled and sealed.

PART 2 - PRODUCTS

2.1 PAINT

A. Available Products:
   2. Color Wheel.

B. MPI Standards: Provide materials that comply with MPI standards indicated and listed in its "MPI Approved Products List."

C. Material Compatibility: Provide materials that are compatible with one another and with substrates.
   1. For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.

D. Use interior paints and coatings that comply with the following limits for VOC content:
   1. Flat Paints and Coatings: 50 g/L.
   2. Nonflat Paints, Coatings: 150 g/L.
   3. Anticorrosive and Antirust Paints Applied to Ferrous Metals: 250 g/L.
   4. Clear Wood Finishes, Varnishes: 350 g/L.
   5. Clear Wood Finishes, Lacquers: 550 g/L.
   6. Floor Coatings: 100 g/L.
   7. Stains: 250 g/L.
   8. Primers, Sealers, and Undercoaters: 200 g/L.
10. Pretreatment Wash Primers: 420 g/L.

E. Colors: As selected.

PART 3 - EXECUTION

3.1 PREPARATION

A. Comply with recommendations in MPI's "MPI Architectural Painting Specification Manual" applicable to substrates indicated.

B. Remove hardware, lighting fixtures, and similar items that are not to be painted. Mask items that cannot be removed. Reinstall items in each area after painting is complete.

C. Clean and prepare surfaces in an area before beginning painting in that area. Schedule painting so cleaning operations will not damage newly painted surfaces.

3.2 APPLICATION

A. Comply with recommendations in MPI's "MPI Architectural Painting Specification Manual" applicable to substrates indicated.

B. Paint exposed surfaces unless otherwise indicated.
   1. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces.
   2. Paint surfaces behind permanently fixed equipment or furniture with prime coat only.
   3. Paint the back side of access panels.
   5. Do not paint prefinished items, items with an integral finish, operating parts, and labels unless otherwise indicated.

C. Apply paints according to manufacturer's written instructions.
   1. Use brushes only for exterior painting and where the use of other applicators is not practical.
   2. Use rollers for finish coat on interior walls and ceilings.

D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.
   1. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.

E. Apply stains and transparent finishes to produce surface films without color irregularity, cloudiness, holidays, lap marks, brush marks, runs, ropiness, or other imperfections. Use multiple coats to produce a smooth surface film of even luster.
3.3 EXTERIOR PAINT APPLICATION SCHEDULE

A. Steel:
   1. Semigloss Alkyd Enamel: Two coats over rust-inhibitive primer: MPI EXT 5.1D.

B. Galvanized Metal:
   1. Semigloss Alkyd Enamel: Two coats over cementitious galvanized-metal primer: MPI EXT 5.3B.

C. Aluminum:
   1. Semigloss, Alkyd Enamel: Two coats over quick-drying primer for aluminum: MPI EXT 5.4F.

D. Stucco:
   1. Flat Latex: Two coats over alkali-resistant primer: MPI EXT 9.1J.

3.4 INTERIOR PAINT APPLICATION SCHEDULE

A. Concrete Masonry Units: (See Room Finish Schedule on plans – many interior CMU walls are to have high performance Epoxy coating)-See Section 09960.
   1. Eggshell Latex: Two coats over latex block filler: MPI INT 4.2A.

B. Steel:
   1. Semigloss, Alkyd Enamel: Two coats over alkyd anticorrosive quick-drying alkyd primer: MPI INT 5.1E.

C. Galvanized Metal:
   1. Semigloss, Alkyd Enamel: Two coats over cementitious galvanized-metal primer: MPI INT 5.3C.

D. Aluminum:
   1. Semigloss, Alkyd Enamel: Two coats over quick-drying primer for aluminum: MPI INT 5.4J.

E. Dressed Lumber: Including architectural woodwork.
   1. Semigloss Latex: Two coats over primer: MPI INT 6.3T.

F. Gypsum Board:
   1. Eggshell Latex: Two coats over primer/sealer: MPI INT 9.2A.

END OF SECTION
PART 1 - GENERAL

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

1.2 SUMMARY
A. This Section includes surface preparation and application of high-performance coating systems on the following substrates:
   1. Interior Substrates:
      a. Concrete, vertical and horizontal surfaces. Products used for horizontal surfaces are to be designed for forklift traffic.
      b. Concrete masonry units (CMU).
      c. Gypsum board.
B. Related Sections include the following:
   1. Division 09 painting Sections for special-use coatings and general field painting.

1.3 SUBMITTALS
A. Product Data: For each type of product indicated.
B. Samples for Initial Selection: For each type of finish-coat product indicated.
C. Samples for Verification: For each type of coating system and in each color and gloss of finish coat indicated.
   1. Submit Samples on rigid backing, 8 inches (200 mm) square.
   2. Step coats on Samples to show each coat required for system.
   3. Label each coat of each Sample.
   4. Label each Sample for location and application area.
D. Product List: For each product indicated. Cross-reference products to coating system and locations of application areas. Use same designations indicated on Drawings and in schedules.

1.4 QUALITY ASSURANCE
A. Master Painters Institute (MPI) Standards:
1. **Products:** Complying with MPI standards indicated and listed in "MPI Approved Products List."

2. **Preparation and Workmanship:** Comply with requirements in "MPI Architectural Painting Specification Manual" for products and coating systems indicated.

**B. Mockups:** Apply benchmark samples of each coating system indicated to verify preliminary selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

   1. Architect will select one surface to represent surfaces and conditions for application of each type of coating and substrate.
      a. **Wall and Ceiling Surfaces:** Provide samples of at least 100 sq. ft. (9 sq. m).
      b. **Other Items:** Architect will designate items or areas required.

   2. Apply benchmark samples after permanent lighting and other environmental services have been activated.

   3. Final approval of color selections will be based on benchmark samples.
      a. If preliminary color selections are not approved, apply additional benchmark samples of additional colors selected by Architect at no added cost to Owner.

**1.5 DELIVERY, STORAGE, AND HANDLING**

**A.** Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F (7 deg C).

   1. Maintain containers in clean condition, free of foreign materials and residue.
   2. Remove rags and waste from storage areas daily.

**1.6 PROJECT CONDITIONS**

**A.** Apply coatings only when temperature of surfaces to be coated and surrounding air temperatures are between 50 and 95 deg F (10 and 35 deg C).

**B.** Do not apply coatings in snow, rain, fog, or mist; when relative humidity exceeds 85 percent; at temperatures less than 5 deg F (3 deg C) above the dew point; or to damp or wet surfaces.

**1.7 EXTRA MATERIALS**

**A.** Furnish extra materials described below that are from same production run (batch mix) as materials applied and that are packaged for storage and identified with labels describing contents.

   1. **Quantity:** Furnish an additional 5 percent, but not less than 1 gal. (3.8 L) of each material and color applied.
PART 2 - PRODUCTS

2.1 HIGH-PERFORMANCE COATINGS, GENERAL

A. Material Compatibility:
   1. Provide materials for use within each coating system that are compatible with
      one another and substrates indicated, under conditions of service and application
      as demonstrated by manufacturer, based on testing and field experience.
   2. Provide products of same manufacturer for each coat in a coating system.

B. VOC Content of Field-Applied Interior Paints and Coatings: Provide products that
   comply with the following limits for VOC content when calculated according to
   40 CFR 59, Subpart D (EPA Method 24):

   1. Nonflat Paints, Coatings, and Primers: VOC content of not more than 150 g/L.
   2. Anticorrosive and Anti-Rust Paints Applied to Ferrous Metals: VOC content of
      not more than 250 g/L.
   3. Floor Coatings: VOC not more than 100 g/L.
   4. Nonflat Interior Topcoat Paints: VOC content of not more than 150 g/L.
   5. Anti-Corrosive and Anti-Rust Paints Applied to Ferrous Metals: VOC not more
      than 250 g/L.
   6. Floor Coatings: VOC not more than 100 g/L.
   7. Stains: VOC not more than 250 g/L.
   8. Primers, Sealers, and Undercoaters: VOC content of not more than 200 g/L.
      g/L.
   10. Pre-Treatment Wash Primers: VOC content of not more than 420 g/L.

C. Chemical Components of Field-Applied Interior Paints and Coatings: Provide topcoat
   paints and anti-corrosive and anti-rust paints applied to ferrous metals that comply with
   the following chemical restrictions; these requirements do not apply to paints and
   coatings that are applied in a fabrication or finishing shop:

   1. Aromatic Compounds: Paints and coatings shall not contain more than 1.0
      percent by weight of total aromatic compounds (hydrocarbon compounds
      containing 1 or more benzene rings).
   2. Restricted Components: Paints and coatings shall not contain any of the
      following:
      a. Acrolein.
      b. Acrylonitrile.
      c. Antimony.
      d. Benzene.
      e. Butyl benzyl phthalate.
      f. Cadmium.
      g. Di (2-ethylhexyl) phthalate.
      h. Di-n-butyl phthalate.
      i. Di-n-octyl phthalate.
j. 1,2-dichlorobenzene.
k. Diethyl phthalate.
l. Dimethyl phthalate.
m. Ethylbenzene.
n. Formaldehyde.
o. Hexavalent chromium.
p. Isophorone.
q. Lead.
r. Mercury.
s. Methyl ethyl ketone.
t. Methyl isobutyl ketone.
u. Methylene chloride.
v. Naphthalene.
w. Toluene (methylbenzene).
x. 1,1,1-trichloroethane.
y. Vinyl chloride.

D. Colors: As selected by Architect from manufacturer's full range.

2.2 BLOCK FILLERS

A. Epoxy Block Filler: MPI #116.

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

2. Products: Subject to compliance with requirements, provide one of the following:

   a. Cloverdale Paint; Epoxy Block Filler, 83065.
   b. Columbia Paint & Coatings; Carboline, Carboguard, 954HB Block Filler.
   c. Coronado Paint; Polyamide Epoxy Block Filler, 101-11.
   d. Diamond Vogel Paints; V-Cote 100, Acrylic Epoxy Block Filler, MC-1234.
   e. Frazee Paint; Ameron, Amerlock 400 BF, 400 BF.
   f. General Paint; Ameron, Amerlock Block Filler, 400BF.
   g. ICI Paints; Devoe Coatings, Devran 224HS, 224HS.
   h. Miller Paint; PPG Aquapon, Polyamide Epoxy Block Filler, 97-685 Series.
   i. PARA Paints; Insl-x, Epoxy Blockfller, EXP 120.
   k. PPG Architectural Finishes, Inc.; Aquapon, Epoxy Block Filler, 97-685.
   l. Rodda Paint Co.; Carboline, Carboguard 954HB.
   m. Sherwin-Williams Company (The); Industrial & Marine, Kem Cat-i-Coat HS Epoxy Filler/Sealer, B24W400/V400 S.
   n. Spectra-Tone; Insl-x, Epoxy Block Filler, EXP 120.

3. VOC Content: Minimum E Range of E1.

   A. Interior Latex Primer/Sealer: MPI #50.
1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

2. Products: Subject to compliance with requirements, provide one of the following:

   a. Benjamin Moore & Co.; Int. Acrylic Latex Moorcraft, Latex Undercoater & Primer Sealer, 253-00].
   b. California Paints; ProPrime, Latex Primer White, 54500.
   c. Cloverdale Paint; Interior Latex Primer Sealer, 05250.
   d. Columbia Paint & Coatings; Premium Pro, Interior Latex Enamel Undercoater, 02-735-PP.
   e. Coronado Paint; Super Kote 5000, Latex Primer-Sealer, 40-11.
   f. Dunn-Edwards Corporation; Eff-Stop, Acrylic Masonry Primer/Sealer, W 709.
   g. Duron Inc.; Interior Acrylic [Drywall Primer, 04-124] [Latex Undercoater, 04-123].
   h. Farrell-Calhoun; Perfik-Seal, Interior Latex Primer-Sealer, 380.
   i. Flex Bon Paints; Interior Alkyd Latex Primer, 1071.
   j. Frazee Paint; Aqua Seal, Interior Vinyl Acrylic Wall Sealer, 061.
   k. General Paint; [Breeze, Super Seal Latex, 51-087] [Tradesman, Latex Sealer, 28-080].
   l. Hirshfield's, Inc.; Hirshfield's Paint Manufacturing, Drywall Primer Interior Latex, 1250.
   m. ICI Paints; Prep-N-Prime, PVA Interior Primer Sealer, 1030.
   n. Insl-x; Aqualock, Waterbase Primer/Sealer/Stain Killer, AQ-0500.
   q. Kwal-Howells Paint; Accu-Pro, Interior Latex Flat Drywall Primer, 0890.
   r. Miller Paint; Kril Primer Sealer, 6040.
   s. Mills Paint; Superior Quality, Interior Latex Primer Sealer, 133.
   t. Northern Paint; Colorlox, Hi Hide Latex Primer, 301-49.
   u. PARA Paints; Prime Tech Hi-Hide Latex Primer, 5799.
   v. Porter Paints; Interior Latex Sealer, 37725.
   w. PPG Architectural Finishes, Inc.; Speedhide, Int. Latex Primer Sealer, 6-2.
   x. Rodda Paint Co.; Scotseal, Heavy Bodied Latex Sealer, 50 7801 1.
   y. Sherwin-Williams Company (The); Quali-Kote, Interior Latex Primer, B28WQ8001.
   z. Spectra-Tone; Jobmaster, PVA Latex Primer Sealer, 74.
   aa. Vista Paint; Seal Cote, 155.

3. Environmental Characteristics:

   a. VOC Content:

      1) Minimum E Range of E2.
      2) Meets or exceeds LEED requirements for VOC content.

2.3 Environmental Performance Rating (EPR): Minimum EPR 2 EPOXY COATINGS

A. Epoxy, Cold-Cured, Gloss: MPI #77.
1. **Available Products**: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

   c. Cloverdale Paint; ClovaCoat 300, 833.
   e. Coronado Paint; Polyamide Epoxy Coating, 101 Line.
   f. Frazee Paint; Ameron, 72HS.
   g. ICI [Devoe (Canada); ICI Devoe, Devran 724, 724-KXXXX] [Paints; Devoe/Fuller, Guardcote, DP34UXX] [Paints (Canada); Devoe Coatings, Devan 724, 724] [Paints (Canada); Devoe, Tru Glaze, 4508].
   h. Insl-x; Insl-Tile II; Activated Epoxy, EP5300.
   i. Miller Paint; PPG Aquapon, Epoxy Cold Cured - Gloss, 95-1.
   j. Mills Paint; Superior Quality, 2 Component Epoxy, 800.
   k. Northern Paint; Phillips, Herculon Epoxy, 83640.
   l. Porter Paints; Porterglaze 4000, Gloss Epoxy, 4000.
   m. PPG Architectural Finishes, Inc.; Aquapon, Epoxy Cold Cured Gloss, 95-1.
   o. Sigma Coatings; Sigma Cover TCP, 7476.
   q. Tower Paint; Epoxy High Gloss Enamel, T8700.

2. **VOC Content**: Minimum E Range of E1.

**PART 3 - EXECUTION**

3.1 **EXAMINATION**

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of work.

1. **Maximum Moisture Content of Substrates**: When measured with an electronic moisture meter as follows:

   a. Concrete: 12 percent.
   b. Masonry (Clay and CMU): 12 percent.
   c. Gypsum Board: 12 percent.

2. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
3. Begin coating application only after unsatisfactory conditions have been corrected and surfaces are dry.
4. Coating application indicates acceptance of surfaces and conditions.
3.2 PREPARATION

A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates indicated.

B. Remove plates, machined surfaces, and similar items already in place that are not to be coated. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and coating.
   1. After completing coating operations, reinstall items that were removed; use workers skilled in the trades involved.

C. Clean substrates of substances that could impair bond of coatings, including dirt, oil, grease, and incompatible paints and encapsulants.
   1. Remove incompatible primers and reprime substrate with compatible primers as required to produce coating systems indicated.

D. Concrete Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Do not coat surfaces if moisture content or alkalinity of surfaces to be coated exceeds that permitted in manufacturer's written instructions.
   1. Clean surfaces with pressurized water. Use pressure range of 1500 to 4000 psi (10,350 to 27,580 kPa) at 6 to 12 inches (150 to 300 mm).

E. CMU Substrates: Remove efflorescence and chalk. Do not coat surfaces if moisture content or alkalinity of surfaces to be coated exceeds that permitted in manufacturer's written

3.3 APPLICATION

A. Apply high-performance coatings according to manufacturer's written instructions.
   1. Use applicators and techniques suited for coating and substrate indicated.
   2. Coat surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, coat surfaces behind permanently fixed equipment or furniture with prime coat only.
   3. Coat back sides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.

B. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of the same material are to be applied. Tint undercoats to match color of finish coat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.

C. If undercoats or other conditions show through final coat, apply additional coats until cured film has a uniform coating finish, color, and appearance.
D. Apply coatings to produce surface films without cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections. Produce sharp glass lines and color breaks.

3.4 FIELD QUALITY CONTROL

A. Owner reserves the right to invoke the following procedure at any time and as often as Owner deems necessary during the period when coatings are being applied:

1. Owner will engage the services of a qualified testing agency to sample coating material being used. Samples of material delivered to Project site will be taken, identified, sealed, and certified in presence of Contractor.
2. Testing agency will perform tests for compliance with specified requirements.
3. Owner may direct Contractor to stop applying coatings if test results show materials being used do not comply with specified requirements. Contractor shall remove noncomplying coating materials from Project site, pay for testing, and recoat surfaces coated with rejected materials. Contractor will be required to remove rejected materials from previously coated surfaces if, on recoating with complying materials, the two coatings are incompatible.

3.5 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

B. After completing coating application, clean spattered surfaces. Remove spattered coatings by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

C. Protect work of other trades against damage from coating operation. Correct damage by cleaning, repairing, replacing, and recoating, as approved by Architect, and leave in an undamaged condition.

D. At completion of construction activities of other trades, touch up and restore damaged or defaced coated surfaces.

   a.

3.6 INTERIOR HIGH-PERFORMANCE COATING SCHEDULE

A. Concrete Substrates, Vertical Surfaces:

1. Epoxy Coating System:

   a. Prime Coat: Epoxy, cold-cured, gloss, MPI #77.
   b. Intermediate Coat, cold-cured, gloss, MPI #77.
   c. Topcoat: Epoxy, cold-cured, gloss, MPI #77.

B. Concrete Substrates, Horizontal Surfaces.
1. Epoxy Coating System:
   a. Prime Coat: Epoxy, cold-cured, gloss, MPI #77.
   b. Intermediate Coat: Epoxy, cold-cured, gloss, MPI #77.
   c. Topcoat: Epoxy, cold-cured, gloss, MPI #77.

C. CMU Substrates:
   1. Epoxy Coating System:
      b. Intermediate Coat: Epoxy, cold-cured, gloss, MPI #77.
      c. Topcoat: Epoxy, cold-cured, gloss, MPI #77.

D. Gypsum Board Substrates:
   1. Epoxy Coating System:
      a. Prime Coat: Interior latex primer/sealer, MPI #50.
      b. Intermediate Coat: Epoxy, cold-cured, gloss, MPI #77.
      c. Topcoat: Epoxy, cold-cured, gloss, MPI #77.

END OF SECTION
PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals: Product Data, Shop Drawings, and Samples.


C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Plastic Laminate: High-pressure laminate engraving stock with face and core in contrasting colors.

2.2 SIGNS

A. Interior Panel Signs: Engraved plastic laminate with beveled edges and rounded corners.

1. Finishes and Colors: As selected from manufacturer's full range description.

2. Tactile Characters: Characters and Grade 2 Braille raised 1/32 inch (0.8 mm) above surface with contrasting colors.

3. Provide signs for all rooms mounted on the wall beside the room door. Signs to include room number and name and handicapped symbol at restrooms.

4. Provide No Smoking signs at outside of all building entry doors (Overhead and swing doors).

PART 3 - EXECUTION

3.1 INSTALLATION

A. Locate signs centered 5'-0" AFF. Install signs level, plumb, and at heights indicated, with sign surfaces free from distortion and other defects in appearance.

B. Wall-Mounted Signs:
1. Two-Face Tape: Mount signs to smooth, nonporous surfaces, other than vinyl.
3. Magnetic Tape: Mount signs to smooth, nonporous surfaces.
4. Silicone-Adhesive Mounting: Attach signs to irregular, porous, or vinyl-covered surfaces.

C. Dimensional Characters: Mount characters with backs in contact with wall surface.

END OF SECTION
SECTION 10280
TOILET, BATH, AND LAUNDRY ACCESSORIES

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals: Product Data.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Stainless Steel: ASTM A 666, Type 304, No. 4 finish (satin), 0.0312-inch (0.8-mm) minimum nominal thickness unless otherwise indicated.

B. Brass: ASTM B 19, ASTM B 16 (ASTM B 16M), or ASTM B 30.

C. Aluminum: ASTM B 221 (ASTM B 221M), Alloy 6063-T6 or 6463-T6.

D. Sheet Steel: ASTM A 1008/A 1008M, 0.0359-inch (0.9-mm) minimum nominal thickness.

E. Galvanized-Steel Sheet: ASTM A 653/A 653M, G60 (Z180).

F. Chromium Plating: ASTM B 456, Service Condition Number SC 2 (moderate service).


H. Tempered Glass: ASTM C 1048, Kind FT (fully tempered).

I. Mirrors: ASTM C 1503, Mirror Glazing Quality, clear-glass mirrors, nominal 6.0 mm thick.


K. Fasteners: Screws, bolts, and other devices of same material as accessory unit, tamper and theft resistant when exposed, and of galvanized steel when concealed.

L. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of six keys to Owner's representative.

2.2 TOILET AND BATH ACCESSORIES

A. Available Manufacturers:
1. Bobrick
2. American Specialties, Inc.

B. Paper Towel Dispenser and Waste Receptacle:
3. Minimum Capacity: 600 C-fold, 800 multi-fold or 1100 single fold.
5. Lockset: Tumbler type.
6. Refill Indicators: Pierced slots at sides or front.

C. Toilet Tissue Dispenser:
2. Type: Roll-in-reserve dispenser with hinged front secured with tumbler lockset, Double-roll dispenser.
5. Operation: Noncontrol delivery with standard spindle
6. Capacity: Designed for 5-inch-(127-mm-) diameter-core tissue rolls.

D. Liquid-Soap Dispenser:
1. Basis-of-Design Product: American Specialties, 0347
5. Stainless-Steel Soap Valve: Designed for dispensing soap in liquid form.
7. Refill Indicator: Window type.

E. Grab Bar
2. Material: Stainless steel, 0.050 inch (1.3 mm) thick.
5. Outside Diameter: 1-1/2 inches (38 mm) for heavy-duty applications.

F. Mirror Unit:
1. Basis-of-Design Product: American Specialties, 0620; 18" x 36"
2. Frame: Stainless-steel channel.

G. Shower Curtain Rod, Shower Hooks and Curtain, Seat and Grab Bars:
1. Basis-of-Design Product: American Specialties, 1204
2. Outside Diameter: 1 inch (25.4 mm).
5. Curtain Hooks: 1200-SHU.
6. Shower Curtain: 1200-V.
7. Folding Shower Seat: 8206
8. Grab Bars: Series 3800

H. Underlavatory Guard:

1. Basis-of-Design Product:
2. Description: Insulating pipe coverings for supply and drain piping assemblies, which prevent direct contact with and burns from piping, and allow service access without removing coverings.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install accessories using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.

1. Install grab bars to withstand a downward load of at least 250 lbf (1112 N), when tested according to method in ASTM F 446.

B. Adjust accessories for unencumbered, smooth operation and verify that mechanisms function properly. Replace damaged or defective items. Remove temporary labels and protective coatings.

END OF SECTION
SECTION 10441
FIRE EXTINGUISHER CABINETS

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals: Product Data.

B. Fire-Rated, Fire-Protection Cabinets: Listed and labeled to comply with requirements in ASTM E 814 for fire-resistance rating of walls where they are installed.

PART 2 - PRODUCTS

2.1 FIRE-PROTECTION CABINETS

A. Fire-Protection Cabinets surface-mounted cabinets for fire extinguishers.

1. Available Products:
   a. J. L. Industries.
   b. Larson’s

B. Cabinet Construction: Nonrated.

1. Fire-Rated Cabinets: Constructed with double walls fabricated from 0.048-inch-(1.21-mm-) thick, steel sheet lined with fire-barrier material.

C. Cabinet Material: Stainless-steel sheet.

1. Trim Style: Rolled trim.
2. Trim Material: Stainless steel.

D. Door Material: Stainless steel.

1. Door Style: Fully glazed with frame.
2. Door Glazing: Clear Acrylic.

E. Accessories: Mounting brackets.

F. Finishes:

1. Stainless steel No. 4 finish:
   a. Exterior of cabinet door, and trim except for those surfaces indicated to receive another finish.
   b. Interior of cabinet and door.
c. Fasteners and mounting hardware to be stainless steel.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install cabinets at 54 inches (1372 mm) above finished floor to top of cabinet.

END OF SECTION
SECTION 10442
FIRE EXTINGUISHERS

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS
   A. Submittals: Product Data.

PART 2 - PRODUCTS

2.1 FIRE EXTINGUISHERS
   A. Portable Fire Extinguishers: NFPA 10, listed and labeled for the type, rating, and classification of extinguisher.
      1. Available Products:
         a. Larsen’s.
         b. J. L. Industries.
      2. Stored-Pressure Water Type: UL-rated 2-A, 2.5-gal. (9.5-L) nominal capacity, in stainless-steel container; with pressure-indicating gage.
      3. Stored-Pressure Antifreeze Type: UL-rated 2-A, 2.5-gal. (9.5-L) nominal capacity, in stainless-steel container; with pressure-indicating gage.
      4. Multipurpose Dry-Chemical Type: UL-rated 2-A:10-B:C, 5-lb (2.3-kg) nominal capacity, in enameled-aluminum container.
   B. Mounting Brackets: Manufacturer’s standard steel, designed to secure fire extinguisher to wall or structure, of sizes required for fire extinguishers indicated, with plated or baked-enamel finish.

PART 3 - EXECUTION

3.1 INSTALLATION
   A. Install mounting brackets in locations indicated at heights acceptable to authorities having jurisdiction.
   B. Install fire extinguishers in mounting brackets and cabinets where indicated.

END OF SECTION
PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals: Product Data

B. Verify dimensions by field measurements before fabricating.

PART 2 - PRODUCTS

2.1 MATERIALS


2.2 SOLID PLASTIC STORAGE LOCKERS

A. Available Products:
   1. Comtec Industries; Tufftec Lockers.
   2. Santana Products, Inc.; Solid Plastic Lockers

B. Unit Sizes:
   1. Width: 18 inches.
   2. Depth: 18 inches.
   3. Height: 2 tiers, 72 inches.

C. Wall Panels: 3/8" HDPE

D. Backs: 3/8" HDPE

E. Tops: 3/8" HDPE

F. Doors: ½" HDPE, Include door strike and padlock hasp. Doors to have ventilation slots.

   1. Hinges: Manuf. Std. aluminum with powder coating to match locker door and frame.
G. Fabrication: Fabricate initial storage locker with front and two sides. Fabricate additional storage lockers similarly, designed to share one side with initial storage locker. Provide bolts, hardware, and accessories as required for complete installation.
1. Fabricate wall panel and door framing with slotted holes for connecting adjacent panels. Hardware and fasteners to be stainless steel.
2. Prehang doors in factory.

H. Finishes: Solid Plastic HPDE w/ orangepeel texture.
1. Color: As selected by Architect from manufacturer's full range.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Anchor lockers over 4" high concrete pad with 3/8-inch- (9.5-mm-) diameter expansion anchors at 12 inches (305 mm) o.c. through bottom panel. Shim panel framing as required to achieve level and plumb installation.

1. Anchor wire mesh storage lockers to walls at 12 inches (305 mm) o.c. through back corner panel framing with fasteners appropriate to substrate. All fasteners, brackets, and hardware to be stainless steel.
2. Attach adjacent lockers to each other through side panel connectors.
3. Install doors complete with door hardware. Adjust to operate easily without binding.

B. Touchup Painting: Clean abraded areas and touch up.

END OF SECTION
SECTION 11310
RESIDENTIAL APPLIANCES

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals: Product Data.

B. Regulatory Requirements: Comply with provisions of the following product certifications:
   1. UL and NEMA: Provide electrical components required as part of residential appliances that are listed and labeled by UL and that comply with applicable NEMA standards.
   2. NAECA: Provide residential appliances that comply with NAECA standards.

C. Accessibility: Where residential appliances are indicated to comply with accessibility requirements, comply with The U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines and ICC/ANSI A117.1.

D. Energy Ratings: Provide appliances that qualify for the EPA/DOE ENERGY STAR product labeling program.

PART 2 - PRODUCTS

2.1 RESIDENTIAL APPLIANCES

   1. Fresh Food Compartment Volume: 15.6 cu. ft. (0.44 cu. M).
   2. Freezer Compartment Volume: 5.13 cu. ft. (0.15 cu. m).
   3. Shelf Area: 3 adjustable glass shelves, 26 sq. ft. (2.42 sq. m).
   4. Provide icemaker unit with door mounted dispenser.
   5. Color to be white.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Built-in Appliances: Securely anchor to supporting cabinetry or countertops with concealed fasteners. Verify that clearances are adequate for proper functioning and rough openings are completely concealed.

B. Freestanding Appliances: Place in final locations after finishes have been completed in each area. Verify that clearances are adequate to properly operate equipment.
C. Test each item of residential appliances to verify proper operation. Make necessary adjustments.

D. Verify that accessories required have been furnished and installed.

END OF SECTION
SECTION 15000

PIPING, GENERAL

PART 1 - GENERAL

1.01 THE REQUIREMENT

A. The Contractor shall furnish and install to the required line and grade, all piping together with all fittings and appurtenances, required for a complete installation. All piping located outside the face of structures or building foundations and all piping embedded in concrete within a structure or foundation shall be considered exterior piping.

B. The Contractor shall furnish and install fittings, couplings, connections, sleeves, adapters, harness rods and closure pieces as required to connect pipelines of dissimilar materials and/or sizes herein included under this Section and other concurrent contracts for a complete installation.

C. The Contractor shall furnish all labor, materials, equipment, tools, and services required for the furnishing, installation and testing of all piping as shown on the Drawings, specified in this Section and required for the Work. Piping shall be furnished and installed of the material, sizes, classes, and at the locations shown on the Drawings and/or designated in this Section. Piping shall include all fittings, adapter pieces, couplings, closure pieces, harnessing rods, hardware, bolts, gaskets, wall sleeves, wall pipes, hangers, supports, and other associated appurtenances for required connections to equipment, valves, or structures for a complete installation.

D. Piping assemblies under 4-inch size shall be generally supported on walls and ceilings, unless otherwise shown on the Drawings or ordered by the Engineer, being kept clear of openings and positioned above "headroom" space. Where practical, such piping shall be run in neat clusters, plumb and level along walls, and parallel to overhead beams.

E. The Contractor shall provide taps on piping where required or shown on the Drawings. Where pipe or fitting wall thicknesses are insufficient to provide the required number of threads, a boss or pipe saddle shall be installed.

F. The work shall include, but not be limited to, the following:

1. Connections to existing pipelines.

2. Test excavations necessary to locate or verify existing pipe and appurtenances.

3. Installation of all new pipe and materials required for a complete installation.

4. Cleaning, testing and disinfecting as required.

G. All piping systems shall comply with Collier County Utilities Standards Manual, latest edition with revisions. In the event of a conflict between the Standards Manual and other Contract provisions, the more stringent requirement shall govern.

1.02 MATERIAL CERTIFICATION AND SHOP DRAWING SUBMITTALS
A. The Contractor shall furnish to the Owner (through the Engineer) a Material Certification stating that the pipe materials and specials furnished under this Section conform to all applicable provisions of the corresponding Specifications. Specifically, the Certification shall state compliance with the applicable standards (ASTM, AWWA, etc.) for fabrication and testing. The requirements for Certifications shall be as specified in Section 01330 entitled "Submittals".

B. Shop Drawings for major piping (2-inches in diameter and greater) shall be prepared and submitted in accordance with Section 01330 - Submittals. In addition to the requirements of Section 01330 entitled "Submittals", the Contractor shall submit laying schedules and detailed Drawings in plan and profile for all piping as specified and shown on the Drawings.

C. Shop Drawings shall include, but not be limited to, complete piping layout, pipe material, sizes, class, locations, necessary dimensions, elevations, supports, hanger details, pipe joints, and the details of fittings including methods of joint restraint.

D. No fabrication or installation shall begin until Shop Drawings are accepted by the Engineer.

1.03 DEFINITIONS

A. Exposed Piping: Piping that is not buried. Exposed piping includes piping outdoors aboveground, piping in buildings, piping on the interior of tanks, piping on the interior of vaults, and piping on the interior of pits.

B. Size: Pipe, fittings, and accessory sizes and references to pipe diameter on the Drawings and in the Specifications are intended to be normal size or diameter, and shall be interpreted as nominal size or diameter.

1.04 PIPELINE DESIGNATIONS

Pipelines are designated in the plans with the following identification code- AA"-BB-CC. The three parts of the code are defined as follows:

A. AA" – Nominal Diameter of the pipeline in inches.

B. BB – Pipeline material. The pipeline materials are as follows:
   1. DI – Ductile iron
   2. PVC – Polyvinyl chloride
   3. CPVC – Chlorinated polyvinyl chloride
   4. SS – Stainless steel
   5. RCP – Reinforced concrete pipe
   6. FRP – Fiberglass reinforced plastic

C. CCC – Functional use designation of the pipelines.
PART 2 - PRODUCTS

2.01 GENERAL

A. All specials and every length of pipe shall be marked with the manufacturer’s name or trademark, size, class, and the date of manufacture. Special care in handling shall be exercised during delivery, distribution, and storage of pipe to avoid damage and unnecessary stresses. Damaged pipe will be rejected and shall be replaced at the Contractor’s expense. Pipe and specials stored prior to use shall be stored in such a manner as to keep the interior free from dirt and foreign matter.

B. Testing of pipe before installation shall be as described in the corresponding ASTM or AWWA Specifications and in the applicable specifications. Field testing after the pipe is installed shall be as specified in Section 02505 Pressure Testing of Piping Systems.

C. Joints in piping shall be of the type as specified and shown in the Drawings.

D. All buried piping shall have restrained joints. All exposed piping shall have flanged joints, unless otherwise specified or shown on the drawings.

E. The Drawings indicate work affecting existing piping and appurtenances. The Contractor shall excavate test pits as required of all connections and crossings which may affect the Contractor’s work prior to ordering pipe and fittings to determine sufficient information for ordering materials. The Contractor shall take whatever measurements that are required to complete the work as shown or specified.

2.02 GENERAL – MATERIALS

A. Pipe, fittings, valves, and appurtenances furnished as part of the Work shall be in accordance with Section 01600 – Materials and Equipment.

B. The general requirements, materials, and installation for the types of pipe specified in this section are listed in the following Sections:

1. Section 15140 – Ductile Iron Pipe

2. Section 15141 – Polyvinyl Chloride (PVC) and Chlorinated Polyvinyl Chloride (CPVC) Pipe.

3. Section 15142 – Stainless Steel Pipe

C. Piping materials shall be as described in this Section unless noted otherwise on the Drawings.

D. All buried PVC or CPVC pipe used for reuse water shall be Federal Safety purple. All buried PVC or CPVC pipe used for potable water shall be blue and white in color.

E. All buried ductile iron pipe and fittings used for reuse water shall have purple polyethylene encasement as specified in Section 15121 – Ductile Iron Pipe.

2.03 MATERIALS FOR WATER, WASTEWATER AND REUSE PIPING SYSTEMS
A. Buried Piping, unless noted otherwise, shall be:
   1. 24” and Larger Piping: Ductile Iron
   2. 14” through 20” Piping: Ductile Iron or PVC C905
   3. 4” through 12” Piping: Ductile Iron or PVC C900
   4. 3” and Smaller Piping: Schedule 80 PVC

B. Interior Exposed and Exterior Continuously Shaded Piping, unless noted otherwise, shall be:
   1. 4” and Larger Piping: Ductile Iron
   2. 3” and Smaller Piping: Schedule 80 PVC

C. Exterior Exposed Piping, unless noted otherwise, shall be:
   1. 4” and Larger Piping: Ductile Iron
   2. 3” and Smaller Piping: Schedule 40S Stainless Steel

D. Gasket Material SBR rubber, Buna-N, Neoprene, Viton or EPDM.

2.04 MATERIALS FOR CHEMICAL PIPING SYSTEMS
A. Sample Piping System Materials
   1. Rigid Piping: PVC or CPVC as noted
   2. Flange Joint Accessories
      a. Fastener Material: AISI Type 316 stainless steel
      b. Gasket and Seal Material: Neoprene

B. Sodium Hydroxide, Anti-Scalant and Ammonium Hydroxide Piping System Materials
   1. Rigid Piping: CPVC
   2. Flexible Piping: Polyethylene
   3. Flange Joint Accessories
      a. Fastener Material: AISI Type 316 stainless steel
      b. Gasket and Seal Material: EPDM

C. Sodium Hypochlorite Solution Piping System Materials
   1. Rigid Piping: CPVC
2. Flange Joint Accessories for Sodium Hypochlorite Piping Systems.
   a. Fastener Material: Hastelloy C
   b. Gasket and Seal Material: Viton

3. Use solvent weld cement and thinner approved for sodium hypochlorite. Submit proposed cement to Engineer for approval.

2.05 MATERIALS FOR DRAIN PIPING SYSTEMS

B. Buried Drain Piping Not Beneath Structures: Ductile Iron, PVC C900 or PVC C905.
C. Exposed Drain Piping: Ductile Iron.
D. Gasket Material: SBR rubber, Buna-N, Neoprene or Nitrile.

2.06 WALL PIPES

A. Where wall sleeves or wall pipes occur in walls that are continuously wet on one or both sides, they shall have water stop flanges at the center of the casting or as shown on the Drawings. Ends of wall pipes shall be flange, mechanical joint, plain end, or bell as shown on the Drawings, or as required for connection to the piping. Wall pipes shall be of the same material as the piping that they are connected to. If welded waterstop flanges are employed, welds shall be 360 degree continuous on both sides of flange. Unless otherwise shown on the Drawings, waterstop flanges shall conform to the minimum dimensions shown below:

<table>
<thead>
<tr>
<th>Pipe Size</th>
<th>Waterstop Flange Diameter</th>
<th>Waterstop Flange Thickness</th>
</tr>
</thead>
<tbody>
<tr>
<td>4&quot; - 12&quot;</td>
<td>OD + 3.10&quot;</td>
<td>0.50&quot;</td>
</tr>
<tr>
<td>14&quot; - 24&quot;</td>
<td>OD + 4.15&quot;</td>
<td>0.75&quot;</td>
</tr>
<tr>
<td>30&quot; - 36&quot;</td>
<td>OD + 4.50&quot;</td>
<td>1.00&quot;</td>
</tr>
<tr>
<td>42&quot; - 48&quot;</td>
<td>OD + 5.00&quot;</td>
<td>1.25&quot;</td>
</tr>
<tr>
<td>54&quot;</td>
<td>OD + 5.90&quot;</td>
<td>1.50&quot;</td>
</tr>
<tr>
<td>60&quot;</td>
<td>OD + 6.00&quot;</td>
<td>1.50&quot;</td>
</tr>
</tbody>
</table>

2.07 SLEEVES

A. Unless shown otherwise, all piping passing through walls and floors shall be installed in sleeves or wall castings accurately located before concrete is poured, or placed in position during construction of masonry walls. Sleeves passing through floors shall extend from the bottom of the floor to a point 3 inches above the finished floor, unless shown otherwise. Water stop flanges are required on all sleeves located in floors or walls which are continually wet or under hydrostatic pressure on one or both sides of the floor or wall.

B. Sleeves shall be cast iron, or fabricated stainless steel in accordance with details shown on the Drawings. If not shown on the Drawings, the Contractor shall submit to the Engineer the
details of sleeves he proposes to install; and no fabrication or installation thereof shall take place until the Engineer's acceptance is obtained. Steel sleeves shall be fabricated of structural steel plate in accordance with the standards and procedures of AISC and AWS. Steel sleeve surfaces shall receive a commercial sandblast cleaning and then be shop painted in accordance with Section 09850 entitled "Painting".

C. When shown on the Drawings or otherwise required, the annular space between the installed piping and sleeve shall be completely sealed against a maximum hydrostatic pressure of 20 psig. Seals shall be mechanically interlocked, solid rubber links, trade name "Link-Seal", as manufactured by the Thunderline Corp., Wayne, Michigan, or equal. Seals shall have Type 316 stainless steel hardware. Rubber link, seal-type, size, and installation thereof, shall be in strict accordance with the manufacturer's recommendations.

D. Cast iron mechanical joint adapter sleeves shall be Clow #1429, as manufactured by the Clow Corp., or equal. Mechanical joint adapter sleeves shall be provided with suitable gasket, follower ring, and bolts to effect a proper seal. In general, sleeves installed in walls, floors, or roofs against one side of which will develop a hydrostatic pressure, or through which leakage of liquid will occur, shall be so sealed. If welded waterstop flanges are employed, welds shall be 360 degree continuous on both sides of flange.

2.08 SOLID SLEEVE COUPLINGS

A. Solid sleeve couplings shall be used to connect buried service piping where shown on the Drawings. Solid sleeves shall be ductile iron, long body and shall conform to the requirements of ANSI A21.10 (AWWA C110). Unless otherwise shown or specified, solid sleeve couplings shall be Style A11760 as manufactured by American Cast Iron Pipe Co., or equal.

2.09 FLEXIBLE COUPLINGS

A. Flexible couplings shall be as manufactured by the Red Valve Company and shall consist of a molded reinforced fabric of cotton and natural rubber. Stainless steel retaining rings shall be furnished. End connections shall match ANSI 125 pound flanges with a minimum pressure rating of 140 psi.

2.10 SLEEVE TYPE COUPLINGS

A. Sleeve type, flexible couplings shall be furnished and installed where shown on the Drawings and as approved by the Engineer. In addition, harnessed, sleeve type flexible couplings shall be provided on all exposed pipe 3 inches and larger in diameter that spans any expansion joint in a building or structure.

B. Materials shall be of type 316 stainless steel and couplings shall be rated for the same pressures as the connecting piping.

C. Gaskets shall be suitable for the materials in the piping system. Bolts and nuts shall be stainless steel.

D. Harnessing

1. Harness couplings to adjacent flanges as shown, specified or otherwise required to restrain all pressure piping.
2. Dimensions, sizes, and spacing for lugs, tie rods, washers, and nuts shall conform to the standards for the pipe size, and design pressure specified.

3. No less than two bolts shall be furnished for each coupling.

4. Tie bolts, nuts and washers shall be type 316 stainless steel.

5. Harness rods shall have lengths less than 10 feet between adjacent flanged joints on fittings.

F. All couplings shall be provided without interior pipe stop.

G. Sleeve Type Coupling suppliers, or equal:
   1. Rockwell (Smith-Blair), Style 411 with materials of construction as noted above.
   2. Dresser, Style 38 with materials of construction as noted above.

2.11 FLANGED ADAPTERS

A. Flanged adapters shall be furnished as required and as shown on the Drawings.

B. All flanged adapters, 12 inches in diameter and smaller, except as shown on the Drawings or directed by the Engineer, shall be locking type flanged adapters with joint restraint.

C. Pressure and service shall be the same as connected piping.

D. Materials shall be high strength steel with fusion bonded epoxy coating inside and out.

E. Flanged adapters shall receive a field coating compatible with the paint systems specified in Section 09850 entitled "Painting".

F. Bolts and nuts shall be Type 316 stainless steel. Gaskets shall be suitable for the materials in the piping system.

G. Flanged coupling adapters larger than 12 inches in diameter shall be harnessed by tying the adapter to the nearest pipe joint flange using Type 316 stainless steel threaded rods and rod tabs. The threaded rods and rod tabs shall be as shown on the Drawings.

H. Flanged adapters shall be as manufactured by Smith Blair Corporation, Model 923 or 911, Ford Type FCA, or approved equal from a U.S. manufacturing facility.

2.12 MECHANICAL COUPLINGS

A. Mechanical couplings shall be furnished as specified, shown on the Drawings or required for proper installation.

B. Materials shall be of malleable iron and couplings shall be rated for the same pressures as the connecting piping.

C. Gaskets shall be suitable for the materials in the piping system. Bolts and nuts shall be stainless steel.
D. After installation, buried couplings shall receive two heavy coats of an approved coal tar which is compatible with the finish of the coupling. Exposed couplings shall be painted in accordance with Section 09960 entitled "Painting".

E. Couplings shall be as manufactured by Victaulic Company of America, Style 31 or equal.

2.13 UNIONS

A. For ductile iron, carbon steel, and grey cast iron pipes assembled with threaded joints and malleable iron fittings, unions shall conform to ANSI B16.39.

B. For copper piping, unions shall have ground joints and conform to ANSI B16.18.

C. For PVC and CPVC piping, unions shall be socket weld type with Viton O-ring.

2.14 GROOVED COUPLINGS

A. All grooved couplings shall be in accordance with AWWA C606.

B. For ductile iron pipe with nominal pipe sizes ranging from three inches to twenty-four inches, groove couplings shall be style 31 or 44 by Victaulic, or equivalent models by Aeroquip or equal. The joint grooving dimensions shall be in conformance to the rigid joint specifications. The gasket shall be a flush-seal type.

C. Pipe wall thickness shall be in accordance with AWWA C606 and as specified herein.

PART 3 - EXECUTION

3.01 INSTALLATION

A. All piping shall be installed by skilled workmen and in accordance with the best standard practice for piping installation as shown on the Drawings, specified or recommended by the pipe manufacturer. Proper tools and appliances for the safe and convenient handling and installing of the pipe and fittings shall be used. Great care shall be taken to prevent any pipe coating from being damaged on the inside or outside of the pipe and fittings. All pieces shall be carefully examined for defects, and no piece shall be installed which is known to be cracked, damaged, or otherwise defective. If any defective pieces should be discovered after having been installed, it shall be removed and replaced with a sound one in a satisfactory manner by the Contractor and at his own expense. Pipe and fittings shall be thoroughly cleaned before they are installed and shall be kept clean until they are accepted in the complete work. All piping connections to equipment shall be provided with unions or coupling flanges located so that piping may be readily dismantled from the equipment. At certain applications, Dresser, Victaulic, or equal, couplings may also be used subject to approval by the Engineer. All piping shall be installed in such a manner that it will be free to expand and contract without injury to itself or to structures and equipment to which it is connected. All piping shall be erected to accurate lines and grades with no abrupt changes in line or grade and shall be supported and braced against movement, temporary, or permanent. All exposed piping shall be installed with vertical and horizontal angles properly related to adjoining surfaces or pipes to give the appearance of good workmanship. Unless otherwise shown or approved, provided a minimum headroom clearance under all piping of 7 feet 6 inches.
B. Unless otherwise shown or specified, all waste and vent piping shall pitch uniformly at a 1/4-inch per foot grade and accessible cleanouts shall be furnished and installed as shown and as required by local building codes. Installed length of waste and vent piping shall be determined from field measurements in lieu of the Drawings.

C. All excavation shall be made in such a manner and to such widths as will provide ample room for properly installing the pipe and permit thorough compaction of backfill around the pipe. The minimum trench widths shall be in strict accordance with the “Trench Width Excavation Limits” as shown on the Drawings. All excavation and trenching shall be done in strict accordance with these specifications and all applicable parts of the OSHA Regulations, 29CFR 1926, Subpart P.

D. Enlargements of the trench shall be made as needed to give ample space for operations at pipe joints. The width of the trench shall be limited to the maximum dimensions shown on the Drawings, except where a wider trench is needed for the installation of and work within sheeting and bracing. Except where otherwise specified, excavation slopes shall be flat enough to avoid slides which will cause disturbance of the subgrade, damage to adjacent areas, or endanger the lives or safety of persons in the vicinity.

E. Hand excavation shall be employed wherever, in the opinion of the Engineer, it is necessary for the protection of existing utilities, poles, trees, pavements, or obstructions.

F. No greater length of trench in any location shall be left open, in advance of pipe laying, than shall be authorized or directed by the Engineer and, in general, such length shall be limited to approximately one hundred (100) feet. The Contractor shall excavate the trenches to the full depth, width and grade indicated on the Drawings including the relevant requirements for bedding. The trench bottoms shall then be examined by the Engineer as to the condition and bearing value before any pipe is laid or bedding is placed.

G. No pipe trench shall be backfilled until required pressure testing has been performed. All testing shall be in accordance with Section 02505, Pressure Testing of Piping Systems.

H. All pipe passing through walls and/or floors shall be provided with wall pipes or sleeves in accordance with the specifications and the details shown on the Drawings. All wall pipes shall be of ductile iron and shall have a water stop located in the center of the wall. Each wall pipe shall be of the same class, thickness, and interior coating as the piping to which it is joined. All buried wall pipes shall have a coal tar outside coating on exposed surfaces.

I. Joint deflection shall not exceed 75 percent of the manufacturer’s recommended deflection. Excavation and backfilling shall conform to the requirements of Section 02317, Trenching, Bedding and Backfill for Pipe, and as specified herein. Maximum trench widths shall conform to the Trench Width Excavation Limits shown on the Drawings. All exposed, submerged, and buried piping shall be adequately supported and braced by means of hangers, concrete piers, pipe supports, or otherwise as may be required by the location.

J. Following proper preparation of the trench subgrade, pipe and fittings shall be carefully lowered into the trench so as to prevent dirt and other foreign substances from gaining entrance into the pipe and fittings. Proper facilities shall be provided for lowering sections of pipe into trenches. Under no circumstances shall any of the materials be dropped or dumped into the trench.
K. Water shall be kept out of the trench until jointing and backfilling are completed. When work is not in progress, open ends of pipe, fittings, and valves shall be securely closed so that no water, earth, or other substance will enter the pipes, fitting, or valves. Pipe ends left for future connections shall be valved, plugged, or capped, and anchored as required.

L. All piping shall be installed in such a manner that it will be free to expand and/or contract without injury to itself or to structures and equipment to which it is connected. All piping shall be erected to accurate lines and grades with no abrupt changes in line or grade and shall be supported and braced against movement, temporary, or permanent. All exposed piping shall be installed with vertical and horizontal angles properly related to adjoining surfaces or pipes to give the appearance of good workmanship. Pipes crossing within a vertical distance of less than or equal to one (1) foot shall be encased and supported with concrete at the point of crossing to prevent damage to the adjacent pipes as shown on the Drawings.

M. The full length of each section of pipe shall rest solidly upon the bed of the trench, with recesses excavated to accommodate bells, couplings, joints, and fittings. Before joints are made, each pipe shall be well bedded on a solid foundation; and no pipe shall be brought into position until the preceding length has been thoroughly bedded and secured in place. Pipe that has the grade or joint disturbed after laying shall be taken up and re-laid by the Contractor at his own expense. Pipe shall not be laid in water or when trench conditions are unsuitable for work.

N. Proper and suitable tools and appliances for the safe convenient handling and laying of pipe shall be used and shall in general agree with manufacturer’s recommendations.

O. At the close of each work day the end of the pipeline shall be tightly sealed with a cap or plug so that no water, dirt, or other foreign substance may enter the pipeline, and this plug shall be kept in place until pipe laying is resumed.

P. During the laying of pipe, each pipe manufacturer shall provide his own supervisor to instruct the Contractor’s pipe laying personnel in the correct procedure to be followed.

Q. All piping bedding shall be as shown on the drawings, unless otherwise specified herein.

3.02 JOINTS IN PIPING

A. **Restrained joints:** shall be provided on all pipe joints as specified herein and shown on the Drawings. Restrained joints shall be made up similar to that for push-on joints. All underground piping and fittings shall use mechanically restrained joints.

B. **Flanged joints:** shall be brought to exact alignment and all gaskets and bolts or studs inserted in their proper places. Bolts or studs shall be uniformly tightened around the joints. Where stud bolts are used, the bolts shall be uniformly centered in the connections and equal pressure applied to each nut on the stud. Pipes in all lines subject to temperature changes shall be cut short and cold sprung into place to compensate for expansion when hot.

C. **Mechanical joints:** shall be made up with gaskets, glands and bolts. When a joint is to be made up, the bell or socket and plain end shall be cleaned and washed with a solution or mild soap in water; the gland and gasket shall be slid onto the plain end and the end then entered into the socket until it is fully “home” on the centering ring. The gasket shall then be painted with soapy water and slid into position, followed by the gland. All bolts shall be
inserted and made up hand tight and then tightened alternately to bring the gland into position evenly. Excessive tightening of the bolts shall be avoided. All nuts shall be pulled up using a torque wrench which will not permit unequal stresses in the bolts. Torque shall not exceed the recommendations of the manufacturer of the pipe and bolts for the various sizes. Care shall be taken to assure that the pipe remains fully "home" while the joint is being made. Joints shall conform to the applicable AWWA Specifications.

D. Threaded and/or screwed joints: shall have long tapered full depth threads to be made with the appropriate paste or jointing compound, depending on the type of fluid to be processed through the pipe. All pipe up to, and including 1-1/2 inches, shall be reamed to remove burr and stood on end and well pounded to remove scale and dirt. Wrenches on valves and fittings shall be applied directly over the joint being tightened. Not more than three pipe threads shall be exposed at each connection. Pipe, in all lines subject to temperature changes shall be cut short and cold sprung into place to compensate for expansion when hot. Joints in all piping used for chlorine gas lines shall be made up with a glycerine and litharge cement. Joints in plastic piping (PVC/CPVC) shall be laid and joints made with compounds recommended by the manufacturer. Installation shall conform to the requirements of ASTM D2774 and ASTM D2855. Unions required adjacent to valves and equipment.

E. Welded joints: shall be made by competent operators in a first class workmanlike manner, in complete accordance with ANSI B31.1 and AWWA C206. Welding electrodes shall conform to ASTM A233, and welding rod shall conform to ASTM A251. Only skilled welders capable of meeting the qualification tests for the type of welding which they are performing shall be employed. Tests, if so required, shall be made at the expense of the Contractor, if so ordered by the Engineer. Unions shall be required adjacent to valves and equipment.

F. Solvent or adhesive welded joints: in plastic piping shall be accomplished in strict accordance with the pipe manufacturer's recommendations, including necessary field cuttings, sanding of pipe ends, joint support during setting period, etc. Care shall be taken that no droppings or deposits of adhesive or material remain inside the assembled piping. Solvent or adhesive material shall be compatible with the pipe itself, being a product approved by the pipe manufacturer. Unions are required adjacent to valves and equipment. Sleeve-type expansion joints shall be supplied in exposed piping to permit 1-inch minimum of expansion per 100 feet of pipe length.

G. Dielectric unions: shall be installed wherever dissimilar metals are connected except for bronze or brass valves in ferrous piping. Unions shall be provided downstream of each valve with screwed connections. The Contractor shall provide screwed or flanged unions at each piece of equipment, where shown, and where necessary to install or dismantle piping.

H. Eccentric reducers: shall be installed where air or water pockets would otherwise occur in mains because of a reduction in pipe size.

3.03 TESTING

A. All testing shall be in accordance with Section 02505, Pressure Testing of Piping Systems.

3.04 PAINTING

A. All piping specified in this Section shall be painted in accordance with Division 9.

END OF SECTION
SECTION 15020
PIPE SUPPORTS

PART 1 - GENERAL

1.01 THE REQUIREMENT

A. The Contractor shall provide all tools, supplies, materials, equipment, and all labor necessary for the furnishing, construction, and installation of all pipe supports, hangers, guides, and anchors shown, specified, or required for a complete and operable piping system, in accordance with the requirements of the Contract Documents.

1.02 CONTRACTOR SUBMITTALS

A. Shop Drawings: The Contractor shall furnish complete shop drawings of all pipe supports, hangers, anchors, and guides, as well as calculations for special supports and anchors, in accordance with Section 01330 Submittals. Calculations shall be signed and sealed by a registered Florida Professional Engineer.

PART 2 - PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Code Compliance: All piping systems and pipe connections to equipment shall be properly supported, to prevent undue deflection, vibration, and stresses on piping, equipment, and structures. All supports and parts thereof shall conform to the requirements of ANSI/ASME B31.1, except as supplemented or modified by these Specifications. Supports for plumbing piping shall be in accordance with the latest edition of the applicable plumbing code, or local administration requirements.

B. Structural Members: Wherever possible, pipes shall be attached to structural members. Where it is necessary to frame structural members between existing members, such supplementary members shall be provided by the Contractor at no additional cost to the Owner. All supplementary members shall be in accordance with the requirements of the building code and the American Institute of Steel Construction.

C. Support Spacing: Supports for piping with the longitudinal axis in approximately a horizontal position shall be spaced to prevent excessive sag, bending and shear stresses in the piping, with special consideration given where components, such as flanges and valves, impose concentrated loads. Spacing of supports shall be as specified herein and/or indicated on the Drawings.

D. Pipe Hangers: Pipe hangers shall be capable of supporting the pipe in all conditions of operation. They shall allow for free expansion and contraction of the piping, and shall prevent excessive stress on equipment. All hangers shall have a means of vertical adjustment after erection. Hangers shall be designed so that they cannot become disengaged by any movement of the supported pipe. Hangers subject to shock, or thrust
imposed by the actuation of safety valves, shall include hydraulic shock suppressors. All hanger rods shall be subject to tensile loading, only.

E. **Hangers Subject to Horizontal Movements:** At hanger locations where lateral or axial movement is anticipated, suitable linkage shall be provided to permit such movement. Where horizontal pipe movement is greater than 1/2-inch, or where the hanger rod deflection from the vertical is greater than 4 degrees from the cold to the hot position of the pipe, the hanger rod and structural attachment shall be offset in such a manner that the rod is vertical in the hot position.

F. **Spring-Type Hangers:** Spring-type pipe hangers shall be provided for piping subject to vibration or vertical expansion and contraction, such as engine exhausts and similar piping. All spring-type hangers shall be sized to the manufacturer’s printed recommendations and the loading conditions encountered. Variable spring supports shall be provided with means to limit misalignment, buckling, eccentric loading, or to prevent overstressing of the spring, and with means to indicate at all times the compression of the spring. The support shall be designed for a maximum variation in supporting effort of 25 percent for the total travel resulting from thermal movement.

G. **Thermal Expansion:** Wherever expansion and contraction of piping is expected, a sufficient number of expansion loops or joints shall be provided, together with the necessary rolling or sliding supports, anchors, guides, pivots, and restraints. They shall permit the piping to expand and contract freely in directions away from the anchored points and shall be structurally suitable to withstand all loads imposed.

H. **Heat Transmission:** Supports, hangers, anchors, and guides shall be so designed and insulated, that excessive heat will not be transmitted to the structure or to other equipment.

I. **Riser Supports:** Where practical, risers shall be supported on each floor with riser clamps and lugs, independent of the connected horizontal piping.

J. **Freestanding Piping:** Freestanding pipe connections to equipment, like chemical feeders, pumps, etc., shall be firmly attached to fabricated steel frames made of angles, channels, or I-beams anchored to the structure. Exterior, freestanding overhead piping shall be supported on fabricated pipe stands, consisting of pipe columns anchored to concrete footings, with horizontal, welded steel angles and U-bolts or clamps, securing the pipes.

K. **Materials of Construction:** All piping shall be supported with hangers, brackets, clips, or fabricated supports and anchors of Type 316 stainless steel, unless otherwise shown.

L. **Point Loads:** Any meters, valves, heavy equipment, and other point loads on PVC, fiber glass, and other plastic pipes, shall be supported on both sides, according to manufacturer’s recommendations to avoid undue pipe stresses and failures. To avoid point loads, all supports on plastic and fiber glass piping shall be equipped with extra wide pipe saddles or galvanized steel shields.

M. **Noise Reduction:** To reduce transmission of noise in piping systems, all copper tubes in buildings and structures shall be wrapped with a 2-inch wide strip of rubber fabric or similar, suitable material, at each pipe support, bracket, clip, or hanger.

2.02 **MANUFACTURED SUPPORTS**
A. **Stock Parts:** Where not specifically shown or detailed, designs, generally accepted as exemplifying good engineering practice, using stock or production parts, shall be utilized wherever possible. Such parts shall be locally available, new, of best commercial quality, designed and rated for the intended purpose. See Article 2.04 of this Section for pipe support materials in chemical containment areas.

B. **Suppliers, or equal:**
   1. Basic Engineers, Pittsburgh, PA;
   2. Bergen-Paterson Corp., Boston, MA;
   3. Elcen Metal Products Company, Franklin Park, IL;
   4. ITT-Grinnell Corp., Warren, OH;
   5. NPS Industries, Inc., Secaucus, NJ.

2.03 **COATING**

A. **Galvanizing:** Unless otherwise shown or specified, all fabricated pipe supports, other than stainless steel or non-ferrous supports, shall be blast-cleaned after fabrication and hot-dip galvanized in accordance with ASTM A 123.

B. **Other Coatings:** Other than the supports mentioned in Paragraph 2.03A, all supports shall receive protective coatings in accordance with the requirements of Section 09960 entitled “Painting.”

2.04 **PIPE SUPPORTS IN CHEMICAL AREAS**

A. Pipe supports in chemical areas shall be wall or slab mounted 1 5/8 X 1 5/8 AIKINSTRUT (or equal) heavy duty FRP channels with stainless steel Type 316 straps, and lock nuts. Supports shall be attached to walls and slabs by 3/8-inch diameter, 6-inch long Type 316 stainless steel anchor bolts with lock nuts. Bolt support spacing shall be maximum 12-inch O.C.

B. Support spacing shall comply with requirements noted in Table 15020-1.

2.05 **NON – METALLIC SUPPORT SYSTEM**

A. Non-metallic supports shall be a heavy duty channel framing system. Channel frames shall be manufactured by the pultrusion process using corrosion grade polyester or vinylester resins.

B. All fiberglass construction shall include suitable ultraviolet inhibitors for exterior UV exposure and shall have a flame spread rating of 25 or less per ASTM E84.

C. All fiberglass construction shall include suitable ultraviolet inhibitors for exterior UV exposure and shall have a flame spread rating of 25 or less per ASTM E84.
D. Piping accessories, pipe clamps, clevis hangers, support posts, support racks, fasteners, etc., shall be constructed of vinylester or polyurethane resin.

E. Non-metallic support systems shall be standard make Aickinstrut by Aickinstrut, Inc., Unistrut Fiberglass by Unistrut, Inc., Enduro Fiberglass Systems, or equal.

F. Unless otherwise shown or specified the Contractor shall provide support spacings in the conformance with the pipe and support system manufacturer’s requirements.

G. The Contractor shall submit data on the support types and sizes for approval.

**PART 3 - EXECUTION**

3.01 INSTALLATION

A. **General:** All pipe supports, hangers, brackets, anchors, guides, and inserts shall be fabricated and installed in accordance with the manufacturer's printed instructions and ANSI/ASME B31.1. All concrete inserts for pipe hangers and supports shall be coordinated with the formwork.

B. **Appearance:** Pipe supports and hangers shall be positioned in such a way as to produce an orderly, neat piping system. All hanger rods shall be vertical, without offsets. Hangers shall be adjusted to line up groups of pipes at the proper grade for drainage and venting, as close to ceilings or roofs as possible, without interference with other Work.

C. **Pipe Support Spacing:** The distance between supports for each size of pipe shall not exceed those listed in the attached schedule. However, if the pipe size to be supported is not listed in the schedule, the next smaller nominal pipe size spacing shall be used. In all cases, there shall be a minimum of one support per laying length of pipe on uninterrupted horizontal runs. This support shall be placed within one foot of the joint. If the pipe manufacturer recommends a smaller spacing interval than specified herein, then the manufacturer's spacing shall be used.

D. The distance between supports shall not exceed that listed in the following schedule unless otherwise noted:

<table>
<thead>
<tr>
<th>Nominal Pipe Size (inch)</th>
<th>Metallic Piping (feet)</th>
<th>Plastic, Fiberglass and Copper Piping (feet)</th>
</tr>
</thead>
<tbody>
<tr>
<td>½</td>
<td>5</td>
<td>3</td>
</tr>
<tr>
<td>3/4 to 1-1/2</td>
<td>6</td>
<td>3</td>
</tr>
<tr>
<td>2 to 3</td>
<td>6</td>
<td>4</td>
</tr>
<tr>
<td>4</td>
<td>10</td>
<td>5</td>
</tr>
<tr>
<td>6 and larger</td>
<td>10</td>
<td>5</td>
</tr>
</tbody>
</table>
3.02 FABRICATION

A. Quality Control: Pipe hangers and supports shall be fabricated and installed by experienced welders and fitters, using the best welding procedures available. Fabricated supports shall be neat in appearance without sharp corners, burrs, and edges.

END OF SECTION
SECTION 15030

PIPING AND EQUIPMENT IDENTIFICATION SYSTEMS

PART 1 - GENERAL

1.01 THE REQUIREMENT

A. The Contractor shall furnish and install all components of the system for identification of piping and equipment as specified hereinafter. The system shall include the application of color coding to all new and altered plant piping. The Contractor shall paint the equipment and piping of all Contracts in the colors herein specified, and in accordance with the requirements of Division 9.

B. In addition to the identification systems specified herein the Engineer may order the Contractor to furnish and install additional identification legends and arrows at no additional cost to the Owner. Such additional signs may be requested near completion of the work and shall be limited to no more than five (5) signs for each type specified herein. The lettering and color combinations for additional signs shall conform to the requirements specified herein.

1.02 SUBMITTALS

A. The Contractor shall submit shop drawings and manufacturer’s product literature in accordance with this Section and Sections 01330 and 01600 entitled “Submittals” and “Materials and Equipment”, respectively. In addition, the Contractor shall submit with the shop drawings a schedule of the colors and designations proposed for each service. A minimum of four (4) color charts with cross-references to the colors and services listed herein shall be included with the Submittal. The Owner shall select the final color for each service during shop drawing review.

PART 2 - PRODUCTS

2.01 PIPING BANDS AND STRIPES

A. All new and altered piping shall receive identification bands. Such bands shall be 6-inches wide, neatly made by masking, and spaced at intervals of 30 inches on centers regardless of the diameter of the pipe being painted. The Contractor may use approved precut and prefinished metal bands on piping, in lieu of the masked and painted bands, where approved by the Engineer. Banding colors shall be as indicated in Article 2.03.

B. Buried potable water piping shall be identified by continuous blue stripes in accordance with FDEP 62-555.

2.02 PIPING IDENTIFICATION LETTERING AND ARROWS

A. The Contractor shall apply identification lettering in the form of plain upper-case block lettering giving the name of the pipe contents and arrows indicating the direction of flow of liquids to all types and sections of piping.
B. All lettering and arrows shall be of the vinyl, self-adhesive tape type or the plastic snap-on/strap-on type with self gripping fasteners. Pipe-marking devices (i.e., tape or snap-on/strap-on type) shall be suitable for a 5 to 8 year outdoor life without discoloration. Pipe marking devices shall be as manufactured by Lab Safety Supply, or equal.

C. Identification lettering and arrows shall be placed as directed by the Engineer, but shall generally be located every ten (10) feet and shall be properly inclined to the pipe axis to facilitate easy reading. Lettering shall also appear directly adjacent to each side of any wall or slab the pipeline passes through, with a minimum of two (2) titles on each pipe in one (1) structure. Identification lettering shall be located midway between color coding bands where possible.

D. Lettering, background and arrow colors shall be the manufacturer’s standard colors unless otherwise directed by the Engineer.

E. All lettering and arrows shall have an overall height in inches in accordance with Table 15030-1.

<table>
<thead>
<tr>
<th>Diameter of Pipe or Pipe Covering</th>
<th>Height of Lettering</th>
</tr>
</thead>
<tbody>
<tr>
<td>3/4 to 1-1/4 inches</td>
<td>1/2 inch</td>
</tr>
<tr>
<td>1-1/2 to 2 inches</td>
<td>3/4 inches</td>
</tr>
<tr>
<td>2-1/2 to 6 inches</td>
<td>1-1/4 inches</td>
</tr>
<tr>
<td>8 to 10 inches</td>
<td>2-1/2 inches</td>
</tr>
<tr>
<td>Over 10 inches</td>
<td>3-1/2 inches</td>
</tr>
</tbody>
</table>

F. The manufacturer’s instructions shall be followed in respect to storage, surface preparation and application.

G. For piping less than 3/4-inch diameter, the Contractor shall furnish and attach corrosion resistant color tags with the required lettering.

H. Pipe lettering shall for each service type shall be as per the Engineer’s direction.

END OF SECTION
SECTION 15110
VALVES AND ACCESSORIES

PART 1 - GENERAL

1.01 SECTION INCLUDES
Requirements for furnishing and installing valves, valve operators and accessories as specified in this Section and shown on the Drawings.

1.02 REFERENCES
A. ANSI Standards
   1. ANSI B16.1 Cast Iron Pipe Flanges and Flanged Fittings, Class 125
   2. ANSI B16.3 Malleable Iron Threaded Fitting, Class 125 and 300
   3. ANSI B16.5 Pipe Flanges and Flanged Fittings, Steel Nickel Alloy and Other Special Alloys

B. ANSI/AWWA Standards
   1. ANSI/AWWA C111/A21.1 Rubber-Gasket Joints for Ductile-Iron and Gray-Iron Pressure Pipe and Fittings
   2. ANSI/AWWA C500 Gate Valves
   3. ANSI/AWWA C504 Rubber Seated Butterfly Valves
   4. ANSI/AWWA C508 Swing Check Valves for Waterworks Service, 2 In. (50 mm) Through 24 In. (600 mm) NPS.
   5. ANSI/AWWA C509 Resilient-Seated Gate Valves 3 through 12 Inch NPS, for Water and Sewage Systems

C. ASTM Standards
   2. ASTM A276 Specification for Stainless Steel and Heat-Resisting Steel Bars and Shapes
   3. ASTM A351 Specification for Steel Castings, Austenitic, for High-Temperature Services

D. MSS Standards

E. ANSI/NSF Standards
   ANSI/NSF 61 Drinking Water System Components-Health Effects

1.03 DEFINITIONS
A. Exposed Valves: Valves that are not buried. Exposed valves include valves outdoors aboveground, valves in buildings, valves on the interior of tanks, valves in the interior of vaults and valves in the interior of pits.
B. Size: References to valve sizes on the Drawings and in the Specifications are intended to be nominal size, and shall be interpreted as nominal size.

1.04 SUBMITTALS
A. General: As specified in Section 01600 - Material and Equipment and Section 01330 – Submittals
B. Manuals as specified in Section 01830 – Operation and Maintenance Data

1.05 WARRANTIES
A. General: As specified in Section 01600 - Material and Equipment and Section 01780 – Warranties and Bonds
B. The Contractor shall warranty all valves, valve operators and appurtenances to be free from defects in material and workmanship for a minimum period of one year as noted in the Contract requirements, and furnish and install any such items found to be defective within the warranty period.

PART 2 – PRODUCTS

2.01 GENERAL
A. Provide valves suitable to the intended service as defined in Division 15 - Mechanical and to meet the standards of the Owner. All valves handling raw or finished water shall be NSF 61 approved for potable water service.
B. Provide valves with joints suitable to connect to adjoining piping.
C. Exposed Valves
   1. Exposed valves shall be provided with valve operators, levers, handwheels, chainwheels and chains, extension stems, bonnet extensions, floor stands, and other accessories as shown or specified.
   2. If distance from operating floor or platform to valve operating wheel is less than six feet, valve or valve operator shall be furnished with a handwheel. If the distance from the operating floor or platform to valve operating wheel is 60 inches or more, the valve or valve operator shall be furnished with a chainwheel and chain. Chains shall terminate four feet above operating floor or platform.
   3. Effort required to operate valve lever shall not exceed 40 pounds applied at the extreme grip position of the lever. Effort required to operate valve handwheel shall not exceed 40 pounds applied at the extremity of the
handwheel. Effort required to operate valve chainwheel shall not exceed 40 pounds applied to the chain.

4. Handwheels on valves 14” and smaller shall not be less than 8” in diameter. Handwheels on valves larger than 14” shall not be less than 12” in diameter.

5. Operators shall have open direction clearly and permanently marked. Operators for shut-off valves shall have position indicators.

6. Exposed valves shall have integrally cast flanged joints that meet the dimension requirements of ANSI B16.1.

D. Buried Valves

1. Buried valves shall be provided with operators, valve boxes, bonnet extensions, floor stands, and other accessories as shown or specified.

2. Buried valves with valve boxes shall be provide with extension stems.

3. Buried shut-off valves shall have position indicators. Buried valves with exposed operators shall have position indicator on valve operators. Buried valves with valve boxes shall have position indicator on extension stem beneath valve box lid.

4. Buried valves with motor actuators shall have an extended bonnet to locate the actuator above ground and a First-Fail shear pin located above ground in an easily accessible location. Refer to details on the Contract Drawings.

5. Buried valves shall have mechanical joints that meet the requirements of ANSI/AWWA C111/A21.1 and these specifications.

E. Operators, General

1. Unless otherwise shown or specified, valves 6” and smaller shall have lever operators. Valves 8” and larger shall have gear-assisted operators.

2. The valve manufacturer shall also provide valve operators. Valve operators shall be installed, adjusted, and tested by the valve manufacturer at the valve manufacturer’s plant.

3. Operators, unless otherwise specified, shall turn counter-clockwise to open.

2.02 CHAINWHEEL OPERATORS

A. Chainwheel operator shall be fabricated of cast iron with epoxy coated pocketed type chainwheels with chain guards and guides.

B. Operators shall have Type 316 stainless steel smooth welded link type chain. Chain that is crimped or has links with exposed ends shall not be acceptable.

C. Chainwheel operators shall be marked with an arrow and the word OPEN indicating direction to open.

2.03 VALVE BOXES
A. Valve boxes shall be adjustable telescope type, adjustable to grade. Valve boxes shall be asphalt varnished cast iron, or enameled cast iron, suitable to withstand heavy traffic. Bases shall be the round type.

B. Valve box covers shall be marked either "WATER", "REUSE" or "SEWER", depending on service.

C. Valve boxes shall be Model No. F-2452, as manufactured by James B. Clow & Sons, Mueller or equal.

2.04 VALVE LABELING

A. Label all exposed valves exclusive of hose bibs and chlorine cylinder valves.

B. Labels shall be square or rectangular, 2" across the flats, minimum and shall be permanently attached to the valve or on a wall adjacent to the valve.

C. Labels for exterior valves shall be 1/16" stainless steel. Labels for interior valves shall be 1/16" stainless steel or plastic. Text as provided by the Engineer shall be permanently engraved on the label.

D. Label all underground valves as shown in the Drawings.

2.05 LIMIT SWITCHES

Provide factory mounted limit or proximity switch on all stainless steel or iron bodied check valves unless noted otherwise on the Contract Drawings.

2.06 BALL VALVES

A. Manufacturers

1. Polyvinyl Chloride (PVC and CPVC) true union ball valves shall be manufactured by Asahi/America, Spears or Heyward.

2. Stainless steel ball valves shall be manufactured by Jamesbury Corporation, Jenkins Bros., Lunkenheimer Flow Control, WM Powell Company or Worchester Controls.

B. PVC or CPVC Ball Valves

1. PVC and CPVC ball valves shall be double union type or flanged with a working pressure of 150 psi, with lever operators.

2. The valve bodies, end pieces, balls and stems shall be constructed of Type 1, Grade 1, PVC or CPVC. The seats shall be constructed of teflon and the seals constructed of Viton. The seals for CPVC ball valves in sodium hydroxide application shall be EPDM. The handles shall be PVC.

3. The ends shall be NPT for sizes up to 2-inch and flanged for sizes over 2-inch.

4. Ball valves for sodium hypochlorite service shall be vented type suitable for the service.
**C. Stainless Steel Ball Valves**

1. Stainless steel ball valves shall be Class 600, three-piece type, with lever operators unless noted otherwise.

2. The valve bodies, end pieces, balls and stems shall be constructed of AISI 316 stainless steel. The seats shall be constructed of teflon and the seals constructed of reinforced teflon.

3. The valves shall have flanged ends, rated 150 psi, for sizes 2 inch and larger and NPT ends for sizes smaller than 2 inches.

**2.07 BUTTERFLY VALVES FOR WATER AND REUSE WATER SERVICE**

A. Manufacturers

Manufacturers of butterfly valves shall be DeZurik, Mueller or Pratt.

B. Valve Standard

1. Butterfly valves and operators up to 72" for water service shall conform to AWWA C504.

2. Valves shall have ductile iron body with stainless steel shaft and disc with EPDM seat.

3. Valves shall have a minimum pressure rating of 150 psi.

4. Valves shall be flanged.

**2.08 BUTTERFLY VALVES FOR AIR SERVICE**

A. Manufacturers

Manufacturers shall be DeZurick, Mueller or Pratt.

B. Valve Description

1. Valves shall be DeZurik, model BGS with lug ends for ANSI Class 125/150 flange connections.

2. Valves shall have ductile iron body with stainless steel shaft and disc with EPDM seat.

3. Valves shall have either 10-position lever or infinite position lever as required by the Engineer. Memory stops shall be included with either lever.

**2.09 GATE VALVES**

A. Manufacturers

1. Manufacturers of iron, gate valves shall be Kennedy, Mueller, US Pipe or equal US manufacturer.

B. Valve Standards
1. Exposed iron, gate valves 3" through 48" and buried iron gate valves 18" through 48" shall meet the requirements of ANSI/AWWA C500.

2. Buried iron gate valves 4" through 16" shall meet the requirements of ANSI/AWWA C509

C. Description

1. All valves 16" and larger in size shall have bevel gear operator.

2. Buried iron gate valves 4" through 16" shall have resilient seats and non-rising stems.

3. Exposed iron gate valves 18" through 48" shall have outside screws and yokes and bypass valves. Horizontally mounted valves shall be provided with rollers and tracks.

4. Exposed iron gate valves 3" through 16" shall have outside screws and yokes.

D. Materials

1. Buried and exposed iron gate valves shall have cast iron valve bodies and gates.

2. Buried and exposed iron gate valves shall have 316 stainless steel bolts and nuts.

3. Exposed iron gate valves shall have malleable iron hand wheels.

2.10 GLOBE VALVES, IRON (3" through 10")

A. Manufacturers of globe valves 3" through 10" shall be Stockham or equal US manufacturer.

B. Description

1. Globe valves shall be stainless steel, bolted bonnet, rising stem OS&Y type with renewable seat and metal disc.

2. The valve shall have a working pressure rating of 150 psig and a static test pressure rating of 300 psig.

3. The valve shall have a stuffing box between the valve body and the stem. The stuffing box assembly shall include valve packing, backseat bushing, packing gland and packing gland flange and fasteners.

4. The valve disc shall mate with the valve seat and have machined smoothed surfaces to provide a drip-tight seal. The valve disc or valve seat shall have no edges or other irregularities that cause seal wear or damage.

2.11 PLUG VALVES

A. Manufacturers

1. Manufacturers of plug valves shall be DeZurik or Millikan.
B. Description
1. Plug valves shall be non-lubricated eccentric plug valves with resilient faced plugs and bolted bonnet. Valves shall have a minimum pressure rating of 150 psi and be drip tight at full valve rating.
2. The port areas all valves shall be 100% of the full pipe area.
3. The valve plug shall be of a one-piece construction and self-supporting. Plugs requiring strengthening members opposite the plug face will not be accepted.
4. The valve stem shall be integral with the plug. The valve stem bearings shall be of the replaceable, sleeve type and located at each end of the plug.
5. The valve shaft seal shall be multiple ring type with V-shaped packing. The seals shall be adjustable and replaceable while the valve is in service.

C. Materials
1. The valve body and plug shall be made of cast iron that meets the casting standards of ASTM A126, Class B. The resilient facing for the plug shall be neoprene.
2. The valve stem bearings shall be made of stainless steel, or corrosive resisting phenolic backed or fiberglass backed woven Teflon fiber.
3. The valve shaft seals shall be made of buna-N rubber.
4. The valve shaft overlay shall be a welded in overlay of 90% nickel content or stainless steel on surfaces contacting the plug face. Coated non-metallic materials will not be accepted.
5. Exposed parts such as nuts, bolts, washers and springs shall be 316 stainless steel.

2.12 CHECK VALVES FOR AIR SERVICE, SWING, DUAL DOORS

A. Manufacturers
1. Manufacturers for swing, dual door, check valves shall be APCO or Techno Corporation.

B. Description
1. Valves shall be wafer or lug style, suitable for use in a horizontal or vertical position.
2. Each valve shall have two spring-loaded, resilient seated doors hinged on a shaft through the center of the valve. The doors shall be opened by the velocity flow and closed by one or more torsion springs the shut the doors before flow reversal occurs.
3. Valves shall have a minimum pressure rating of 150 psi and minimum temperature rating of 250ºF.

C. Joints
1. Valves shall fit between two 125 pound or 150 pound ANSI flanges.

D. Materials
1. The valve body, dual doors, hinge pin, stop pin, and torsion springs material shall be AISI 316 stainless steel.
2. Valve seat material shall be EPDM.

2.13 CHECK VALVES FOR WATER SERVICE, SWING, SINGLE DISC

A. Manufacturers
Manufacturers of iron single disc swing check valves shall be Mueller or equal US manufacturer.

B. Description
1. Valves shall be the single disc swing check type suitable for use in a horizontal position.
2. Valves shall have outside weight and lever, unless otherwise shown on the Drawings.
3. Valves shall have a pressure rating of 300 pound test.
4. All valves shall have factory mounted limit switch or proximity switch unless shown otherwise on the Contract Drawings.

C. Joints
Valves shall have integrally cast flange joints that meet the dimensions requirements of ANSI B16.1.

D. Materials
1. The valve body shall be cast iron or ductile iron.
2. Valve accessories shall be bronze.

2.14 CHECK VALVES FOR WATER SERVICE, SLANTING DISC

A. Manufacturers
1. Manufacturers of slanting disk check valves shall be APCO or Val-Matic with hydraulic buffer system for automatic controlled closing of the valve.

B. Description
1. Valves shall be the single disc, slanting or tilted check type suitable for use in a horizontal position
2. Each slanting disc check valve shall have a disc, attached to a one-piece shaft that results in an offset pivot. When the check valve is open the disc shall pivot around the shaft.
3. The minimum flow area shall be 100% of the cross-section area of the specified pipe size.
4. The valve shall have a minimum, non-shock working pressure of 150 psi.
5. All valves shall have factory mounted limit switch or proximity switch unless otherwise shown on the Contract Drawings.

C. Materials

1. The valve body shall be made of cast iron that meets the requirements of ASTM A126, Class B.
2. The disc shall be made of cast iron that meets the requirements of ASTM A126, Class B or bronze.
3. The disc ring and seat ring shall be bronze that meets the requirements of ASTM B271.
4. The pivot pins and pin bushings shall be bronze or stainless steel.

2.15 CHECK VALVES FOR GRIT, SCUM, MIXED LIQUOR, WASTEWATER AND SLUDGE SERVICE, SWING RUBBER FLAPPER

A. Manufacturers

1. Manufacturers of rubber flapper swing check valves shall be APCO or Val-Matic.

B. Description

1. Each rubber flapper swing check valve shall have a flapper, attached to a one-piece shaft, which swings out the flow path when fully open. When the check valve is open the flapper shall be captured between the valve body and valve cover.
2. The valve seating surface shall be at a 45° angle.
3. The minimum flow area shall be 100% of the cross-section area of the specified pipe size.
4. The valve shall have a minimum, non-shock working pressure of 150 psi.
5. The rubber flapper shall be replaceable through the top of the valve by removing the valve cover.
6. All valves shall have factory mounted limit switch or proximity switch unless shown otherwise on the Contract Drawings.

C. Joints

1. Valves shall have integrally cast flanged joints that meet the requirements of ANSI B16.1.

D. Materials

1. The valve body shall be made of cast iron that meets the requirements of AST A126, Class B.
2. The flapper shall be Buna-N reinforced with steel. The flapper seal shall be O-ring type.

2.16 CHECK VALVES, SWING, SINGLE-DISC, STAINLESS STEEL

A. Manufacturers

1. Manufacturers for stainless steel, swing check valves shall be WM Powell Company or equal US manufacturer

B. Description

1. Stainless steel swing check valves 3" through 8" shall have a single disc that swings out the flow path when fully open. The disc shall be suspended from the valve cap.

2. Stainless steel swing check valves 2" and smaller shall have a single disc that swings out of the flow path when fully open. The disc shall be attached to a one-piece shaft that extends through the valve body.

3. The minimum pressure rating of 3" through 8" valves shall be 150 psi. The minimum pressure rating for valves 2" and smaller shall be 200 psi.

C. Joints

1. Valves 3" through 8" shall have integrally cast flange joints that meet the dimension requirements of ANSI B16.1

2. Valves 2" and smaller shall have NPT joints.

D. Materials

1. For valves 3" through 8" the valve bodies, caps and discs shall be made of AISI Type 316 stainless steel that meets the requirements of ASTM A351, Grade CF8M.

2. For valves 2" and smaller the valve bodies shall be made of AISI Type 316 stainless steel that meets the requirements of ASTM A743, Grade CF3M. The valve caps and discs shall be made of AISI Type 316 stainless steel that meets the requirements of ASTM A743, Grade CF8M.

2.17 DIAPHRAGM VALVES FOR SODIUM HYPOCHLORITE SERVICE

A. Manufacturer shall be Asahi/America, or equal.

B. Description

5. Valves shall be used for sodium hypochlorite service as shown on the Drawings. Valves shall be molded CPVC.

6. Valves shall be Type 15 as manufactured by Asahi/America

C. Joints
Valve shall have molded flanged ends conforming to ANSI B16.1.

D. Materials

The valve body shall be CPVC, and the diaphragm shall be PTFE with a PVDF gas barrier.

2.18 HOSE BIBB SIGNAGE

A. Provide 3/16 inch aluminum identification plate at all hose bibs with reuse water. Plate shall be approximately 6 inches by 8 inches and have permanent lettering identifying “Non-Potable – Do Not Drink”.

B. Secure sign to hose bibb post or adjacent handrail with stainless steel fasteners.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Verify operator orientation with Engineer prior to valve installation.

B. Install valves, operators, extension stems, valve boxes, and other accessories in accordance with the manufacturer’s written instructions and as shown and specified. Support valves so that there are no undue stresses on pipe.

C. Install valves with easy access for operation, removal, and maintenance. Install valves so that there are no conflicts between valve operators and structural members or handrails.

D. Install valves, sensors, switches, and controls so that all systems are compatible and operate properly.

E. Install valve boxes perpendicular, centered around and covering the upper portions of the valve or valve operator, or the pipe. The top of each valve box shall be flush with finish grade unless otherwise indicated on the Drawings.

3.02 TESTING

A. While testing the appurtenant pipeline and system of which the valve is a part, operate the valve or test the valve function to ensure proper operation.

B. Operate each valve through the range of operation without fluid flow.

3.03 MANUFACTURERS’ REPRESENTATIVE

A. General: As specified in Section 01600 – Materials and Equipment

B. Provide services of valve manufacturer’s representative as required to obtain correct installation of valves and accessories.

END OF SECTION
SECTION 15114
MISCELLANEOUS VALVES AND APPURTENANCES

PART 1 - GENERAL

1.01 THE REQUIREMENT

A. The Contractor shall furnish and install miscellaneous valves as shown and as specified herein, complete and operable including accessories and, where designated, operators, all in accordance with the requirements of the Contract Documents.

1.02 SUBMITTALS

A. General: As specified in Section 01600 – Material and Equipment and Section 01330 – Submittals.

B. Manuals as specified in Section 01830 – Operation and Maintenance Data.

PART 2 - PRODUCTS

2.01 PRESSURE SUSTAINING VALVE/BACK PRESSURE VALVE

A. The valve shall be 8” Model 650-01 with 150 lb. flange as manufactured by Cla-Val Co. Newport Beach CA, or approved equal. The valve shall have the capability to operate as pressure Sustaining, back pressure, or pressure relief valve.

B. The valve shall be hydraulically operated, pilot controlled, modulating valve designed to maintain constant upstream pressure within closing limits. In operation, the valve is actuated by line pressure through a pilot control system, opening fast to maintain steady line pressure but closing gradually to prevent surges. Operation shall be completely automatic and pressure setting shall be easily adjusted.

C. The valve construction shall be stainless steel including the body and cover, disc retainer, diaphragm washer, trim (disc guide, seat and cover bearing). The disc shall be Buna-N Rubber and the diaphragm shall be nylon reinforced Buna-N Rubber.

2.02 REDUCED PRESSURE ZONE BACK FLOW PREVENTER

A. Reduced pressure zone backflow preventers shall be as per Appendix G of the Collier County Utilities Standards Manual.

2.03 TAPPING VALVE AND SLEEVE

A. The tapping valves shall conform to the applicable requirements of ANSI/AWWA C500. Valves shall be installed as shown on the Drawings and shall be designed for 150 psi working pressure. Valve body shall be cast iron ASTM A 126, Class B or ductile iron ASTM A 395 or A 536. Valves shall have a bronze trim, double disc, a non-rising stem and parallel or inclined seats. Stem seals shall be neoprene O-rings. The valve shall open counter clockwise and have enclosed bevel gears, track rollers and scrapers and a standard bypass
valve. The inlet shall be ANSI sized to match the tapping sleeve. The outlet shall be a mechanical joint connection. The valves shall be as manufactured by Mueller, American, or equal.

B. The Contractor shall verify the material and diameter of the existing lines to be tapped prior to ordering the sleeve.

2.04 CORPORATION STOPS

A. Corporation stops shall be provided with all service saddle connections. Corporation stops shall be O-ring sealed, balance pressure, plug type valves having a full open unobstructed flow way. Corporation stops shall be suitable for buried service and shall have threaded inlet and outlet connections unless otherwise indicated.

B. The suppliers shall be the following or equal:
   1. Ford Meter Box Company;
   2. James Jones Company;

2.05 TAPPING SADDLES

A. Tapping saddles shall fit to the maximum O.D. of the saddle’s range, and extend a minimum of 160 degrees around the pipe. When the saddle is used on pipe to the minimum pipe size of the range, the saddle shall extend 180 degrees around the pipe. Straps shall have ends chamfered and be provided with Class 2 fit, National Coarse Threads. Saddle casting shall be ductile iron, double strap and shall have epoxy coating. Straps shall be stainless steel. Valve gaskets shall be self sealing, neoprene except for chlorine lines which shall be viton.

2.06 SOLENOID VALVES

A. Solenoid valves shall be of the size, type, and class shown and shall be designed for not less than 150 psi water-working pressure. Valves for water, air, or gas service shall have stainless steel body with female NPT threaded connections, suitable for installation in any position, stainless steel trim and spring, Teflon or other resilient seals with material best suited for the temperature and fluid handled. For chemicals and all corrosive fluids, solenoid valves with Teflon bodies and springs or other suitable materials shall be used. Enclosures shall be NEMA 4X. For explosion proof, corrosive, or special purpose NEMA type 7, 8, 9, 9E, 9F, or 9G enclosures shall be used, as applicable. All coil ratings shall be extra heavy duty and suitable for continuous duty. For electrical characteristics see the Electrical Drawings and Specifications.

B. Solenoid valve shall be Automatic Switch Co., Circle Seal Control Inc., Hex Valve, or Equal.

2.07 SMALL PRESSURE REDUCING VALVES (AIR AND WATER)

A. Small air and water pressure reducing valves shall be of the spring-loaded diaphragm type with a minimum pressure rating of 250 psi, with bronze body, nickel alloy or stainless steel
seat, and threaded ends. Each valve shall be furnished with built-in or separate strainer and union ends.

B. The suppliers shall be the following or equal:
   1. Mueller Company.

2.08 NEEDLE VALVES

A. Needle valves shall be Globe type, stainless steel body with threaded end connections at 400 psi in non-shock cold water service. Needle valves shall be as manufactured by Crane, Lunkenheimer, or equal.

2.09 PRESSURE GAUGES

A. Gauges shall be 4” face diameter (unless specified otherwise) with stainless steel case, glycerin filled. Gauges shall be McDaniel all stainless Model E with standard connection or approved equal.

B. Gauges shall be equipped with stainless steel shut-off valves.

C. Gauges on air, potable water and NPW piping shall have a stainless steel snubber.

D. Range shall be 0-100 psi.

2.10 LIMIT/PROXIMITY SWITCHES FOR CHECK VALVES

A. Unless Noted otherwise, all stainless steel or iron bodied check valves over 2 inches in diameter shall be equipped with a factory mounted limit/proximity switch.

B. The switches shall be mounted using stainless steel fasteners and supports.

C. The switches shall be NEMA-4, double pole, double throw, snap action with stainless steel construction and rated for heavy duty service, Honeywell or approved equal.

PART 3 -- EXECUTION

3.01 INSTALLATION

A. All valves shall be installed in accordance with the Supplier's printed recommendations.

B. All air and vacuum release valves shall have piped outlets to the nearest acceptable drain, firmly supported, and installed in such a way as to avoid splashing and wetting of floors.

END OF SECTION
SECTION 15121

PIPING EXPANSION COMPENSATION

PART 1 -- GENERAL

1.01 THE REQUIREMENT

A. Reference Section 15000 entitled "Piping, General".

PART 2 -- PRODUCTS

2.01 RUBBER EXPANSION JOINTS

A. Rubber expansion joints shall be of the single wide arch design and shall be rated for 225°F (dry) or 210°F (wet). Units shall be provided with stainless steel retaining rings. Exposed expansion joints shall be fully resistant to ultra violet degradation. Submerged expansion joints shall be fully resistant to attack from organisms or chemicals found in the associated process liquid.

B. Expansion joints shall be located as shown on the Drawings and shall be for either wet (W) or dry (D) service. The performance of the expansion joints shall be as indicated in the following table.

<table>
<thead>
<tr>
<th>Nominal Pipe Diameter (In)</th>
<th>Minimum Required Movement</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Comp. (In)</td>
</tr>
<tr>
<td>1 - 1-1/2</td>
<td>5/8</td>
</tr>
<tr>
<td>2 - 5</td>
<td>1-3/4</td>
</tr>
<tr>
<td>6 - 12</td>
<td>1-3/4</td>
</tr>
<tr>
<td>14 - 20</td>
<td>2</td>
</tr>
<tr>
<td>24 - 84</td>
<td>2-1/4</td>
</tr>
</tbody>
</table>

C. Control rods to prevent over extension shall be provided as indicated on the Contract Drawings or as required by the manufacturer. All expansion joints shall be the product of a single manufacturer.

D. Expansion joints shall be Style 1015 as manufactured by General Rubber Corporation, or equal.

2.02 BURIED PIPE EXPANSION JOINTS

A. Buried pipe expansion joints shall be installed at the locations indicated on the Contract Drawings and shall be manufactured from ductile iron, Grade 60-42-10 and conforming to ANSI A21.53 (AWWA C153). Buried pipe expansion joints shall be capable of axial expansion and contraction with a minimum of 4-inches total movement. All joint assemblies shall be furnished preset for a minimum of 2-inches expansion and 2-inches contraction. All
pressure containing parts shall be lined with a minimum of 15 mils of Fusion Bonded Epoxy conforming to AWWA C213. The lining shall also conform to the applicable requirements of ANSI A21.11 (AWWA C111). All bolts used in the assembly shall be stainless steel and coated with coal tar epoxy. The buried pipe expansion joint shall be pressure rated at 350 psi with a minimum safety factor of 3:1, and shall be tested to 350 psi prior to shipment.

B. Buried pipe expansion joints shall be similar to the Ex-Tend expansion joint as manufactured by EBAA Iron Inc., Eastland, Texas, or equal.

END OF SECTION
SECTION 15122

DUCTILE IRON PIPE

PART 1 – GENERAL

1.01 SECTION INCLUDES

Requirements for materials and installation of ductile iron piping and fittings as shown on the Drawings.

1.02 REFERENCES

A. ANSI Standards

1. ANSI B16.1 Cast Iron Pipe Flanges and Flanged Fittings, Class 125
2. ANSI B 16.3 Malleable Iron Threaded Fittings, Class 150 and 300
3. ANSI B 16.5 Pipe Flanges and Flanged Fittings, Steel Nickel Alloy and Other Special Alloys

B. ANSI/NSF

ANSI/NSF 61 Drinking Water System Components-Health Effects

C. ANSI/AWWA Standards

1. ANSI/AWWA C104/A21.4 – Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water
2. ANSI/AWWA C105/A21.5 – Polyethylene Encasement for Ductile-Iron Piping for Water and Other Liquids
3. ANSI/AWWA C110/A21.10 – Ductile Iron and Gray-Iron Fitting 3-inch through 48 inch for Water and Other Liquids
5. ANSI/AWWA C1115/A21.15 – Flanged Ductile-Iron Pipe with Threaded Flanges
7. ANSI/AWWA C151/A21.5 – Ductile-Iron Pipe, Centrifugally Cast, for Water and Other Liquids.
8. ANSI/AWWA C600 – Installation of Ductile-Iron Water Mains and Their Appurtenances

D. ASTM Standards

1. ASTM A182 Specification for Forged or Rolled Alloy-Steel Pipe Flanges, Forged Fittings, and Valves and Parts for High Temperature Service
2. ASTM A193 Specification for Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service
3. ASTM A194 Specification for Carbon and Alloy Steel Nuts for Bolts for High-Pressure and High-Temperature Service

1.03 SUBMITTALS

A. General: As specified in Section 01600 – Materials and Equipment and Section 01330 – Submittals.

B. Shop Drawings: Include the following in each submittal:

1. Specification Section number;
2. Catalog data including the following:
   a. Specifications;
   b. Intended Service;
   c. Maximum working pressure;
   d. Illustrations in sufficient detail to serve as a guide for assembly and disassembly;
   e. Materials of construction;
   f. Dimensions;
3. Linings and Coatings.
4. Additional information required to evaluate the proposed piping appurtenance product’s compliance with the Contract Documents.
5. Layout and Installation: Include the following:
   a. Dimensions and elevations;
   b. Piece numbers coordinated with the tabulated pipe layout schedule;
   c. Weight of all component parts;
   d. Design calculations;
   e. Tabulated piping layout schedule including the following:
      (1) Piece number;
      (2) Service;
      (3) Pipe, fitting and accessory sizes;
      (4) Accessory descriptions.
6. Pipe supports and anchors including the following:
   a. Location;
   b. Support type;
   c. Anchor type;
   d. Support an anchor dimensions;
   e. Hanger rod size;
   f. Loads on supports and anchors
C. Certifications

1. Prior to delivery at project site, furnish an Affidavit of Compliance certified by the piping product manufacturer that the pipe, fittings, valves, joint accessories, and other piping appurtenances furnished under this Contract comply with all applicable provisions of applicable referenced standards and these Specifications.

2. Do not deliver pipe product to job site until Affidavit of Compliance has been submitted and accepted by the Engineer.

PART 2 - PRODUCTS

2.01 General

A. Pipe, fittings, and accessories furnished under this section shall be in accordance with the requirements of Section 01600 – Materials and Equipment.

B. Pipe and fittings shall be manufactured either within the United States or by a manufacturer and production factory with current ISO 9001 certification. If applicable, the ISO certification must be included in the submittal and reference compliance with AWWA Standards.

2.02 MANUFACTURERS OF DUCTILE IRON PIPE AND FITTINGS

A. Ductile iron pipe shall be manufactured by:
   1. American Cast Iron Pipe Company
   2. McWane Cast Iron Pipe Company
   3. United States Pipe & Foundry Company

B. Ductile iron fittings shall be manufactured by:
   1. American Cast Iron Pipe Company
   2. Union Foundry Company
   3. United States Pipe & Foundry Company

2.03 DUCTILE IRON PIPE, FITTINGS, AND APPURTENANCES

A. Ductile Iron Pipe

1. Ductile iron pipe shall conform to ANSI/AWWA C151/A21.51.

2. Minimum Thickness - Ductile iron pipe shall conform to the thickness standards in ANSI/AWWA C150/A21.50 and have the minimum pressure classes as follows:
   a. 4” through 12” Pipe: Class 350
   b. 14” through 20” Pipe:
      (1) Depth of Cover <5’-10’: Class 250
      (2) Depth of Cover 10’ to 15’: Class 300
      (3) Depth of Cover >15’: Class 350
c. 24” through 64” Pipe:
   (1) Depth of Cover <5 to 10’: Class 200
   (2) Depth of Cover 10’ to 15’: Class 300
   (3) Depth of Cover >15’: Class 350

3. Flange Joint Ductile Iron Pipe shall conform to the thickness standards in ANSI/AWWA C115/A21.15, Table 15.1 and have a minimum working pressure rating of 250 psi.

B. Fittings

1. Fittings 3” through 48” shall conform to ANSI/AWWA C110/A21.10.

2. Fittings larger than 48” shall conform to ANSI/AWWA C153/A21.53.


C. Pipe and Fitting Joints

1. Joint Type
   a. Joints for buried ductile iron pipe and fittings shall be restrained. Restrained joints shall be restrained push-on joints or mechanical joints with retainer glands.
   b. Joints for exposed ductile iron pipe and fittings shall be flange joints.

2. Restrained push-on joints for ductile iron pipe shall be:
   a. American Cast Iron Pipe Company: Fast-Grip gasket (4” - 12”), Flex-Ring, Field Flex-Ring and Lok-Ring;
   b. McWane Cast Iron Pipe Company: Super Lock;
   c. United States Pipe & Foundry Company: Field Lok gasket (4” - 12”) and TR-Flex.

3. Restrainment Devices for Mechanical Joints
   a. EBAA Iron Sales, Inc., Megalug Series 1100;
   b. or equal restraining device by US manufacturer.

4. Flanges for Pipe and Fittings
   a. Flanges for ductile iron pipe shall be made of ductile iron that conforms to ANSI/AWWA C115/A21.15125.
   b. Flanges for ductile iron fittings shall be made of ductile iron or cast iron that conforms to ANSI/AWWA C110/A21.10.
   c. All flanges shall have flat faces and meet the dimensions standards of ANSI B16.1, Class 125.

D. Lifting Eyes for Ductile Iron Blind Flanges

1. Pipe Size: 12” and larger.
2. Lifting Eyes: Welded or threaded eye bolts.


E. Lining

1. All water service, ductile iron pipe and fittings upstream of the membrane skids shall have a fusion bended epoxy coating applied to 100% of the interior surfaces exposed to water. The lining shall be NSF 61 approved and in accordance with AWWA C116.

2. Ductile iron pipe used in wastewater applications shall have an epoxy lining. The epoxy lining shall be Protecto 401 Ceramic Epoxy as manufactured by the Protecto Division of Vulcan Painters, Inc., or equal. Line all pipe and fittings with a minimum dry film thickness of 40 mils, except for the gasket groove and spigot end up to six inches back from the end of the spigot which shall be lined with ten mils of the material.

3. Ductile iron pipe used for reclaimed water shall have a double-thick cement mortar lining that conforms to ANSI/AWWA C104/A21.4.

4. Ductile iron pipe used in water systems shall have a single thick cement mortar lining that conforms to ASNI/AWWA C104/A21.4.

5. The seal coat for cement mortar lining shall meet the requirements of ANSI/NSF 61.

F. Exterior Coatings

1. Buried ductile iron pipe and fittings shall have an exterior asphaltic coating that conforms to ANSI/AWWA C151/A21.51.

2. Exposed ductile iron pipe and fittings shall have an exterior coating of rust inhibitive primer as specified in Division 9.

G. Encasement for Ductile Iron Pipe

1. Provide polyethylene encasement for all buried pipe, fittings and valves.


2.04 JOINT ACCESSORIES

A. Gaskets

1. Flange joint gaskets for ductile iron shall be full face.

2. Gasket Material
   a. Joints Outside of Buildings: 1/8" neoprene
   b. Joints Inside of Enclosed Buildings: 1/8" neoprene or red rubber.


4. Union and Strainer Gaskets: Viton

B. Bolts, Studs, and Nuts

1. Bolts, Studs, and Nuts for Flange Joints
a. Bolts for flange joints shall be semi-finished, regular hexagon head cap screws with UNC threads. The bolts shall be AISI 316 stainless steel that meets the requirements of ASTM A193, Grade B8M.

b. Studs for flange joints shall have UNC threads and extend through the nuts a minimum of 1/4". The studs shall be AISI 316 stainless steel that meets the requirements of ASTM A193, Grade B8M.

c. Nuts for flange joints shall be semi-finished regular hexagon nuts with UNC threads. The nuts shall be AISI 316 stainless steel that meets the requirements of ASTM A194, Grade 8M.

2. Bolts and Nuts for Mechanical Joints

a. Bolts for mechanical joints shall be tee-head type. The bolts shall be cast iron that meets the requirements of ANSI/AWWA C111/A21.11.

b. Nuts for mechanical joins shall be hexagon type. The nuts shall be cast iron that meets the requirements of ANSI/AWWA C111/A21.11.

**PART 3 - EXECUTION**

**3.01 INSTALLATION OF BURIED PIPE**

A. Laying Piping: Laying of ductile iron pipe shall meet the requirements of ANSI/AWWA C600, unless otherwise specified in this Section, and Section 02317 – Trenching, Bedding and Backfill for Pipe.

1. Provide proper implements, tools, and facilities for safe and expeditious prosecution of Work.

2. Lay and maintain pipe to lines shown on the Drawings, except as specified in this Section. Lay and maintain pipe to grade shown on Drawings or to minimum depth specified in this Section. Install fittings and valves in locations shown on the Drawings.

3. Where piping is to be constructed parallel to and close to existing buried utilities, the exact location of which is unknown, adjust alignment of piping to least interfere with existing buried utilities, unless otherwise shown or specified.

4. Separation of utilities and minimum depth of cover shall be as specified by local ordinance.

5. Do not lay pipe in water or when trench or weather conditions are unsuitable for proper installation.

6. Lower pipe, fittings, and valves into trench by hand, by means of hoists or ropes, or by other suitable tools or equipment that will not damage products, coatings, or linings. Do not drop or dump pipe, fittings, or valves into the trench.

7. Use laser beam equipment, surveying instruments, or other proven techniques to maintain accurate alignment and grade.

8. Lay each pipe section in a firm foundation of bedding material.
9. Bell Holes: Excavate bell holes in advance of pipe laying so that entire barrel will bear uniformly on bedding.

10. Deflection of pressure pipe from a straight line or grade shall not exceed limits specified in this Section. If alignment requires joint deflections in excess of allowable deflection per joint, furnish, and install fittings or a sufficient number of shorter lengths of pipe.

11. Provide piping, 3” and larger, with two short lengths of pipe, not to exceed 4 feet, for first two joints outside a building or tank wall unless a greater number of joints is shown on the Drawings.

12. Provide thrust restraint at horizontal and vertical deflection fittings and at tees, plugs, tapping sleeves, and tapping saddles as specified in this Section.

13. At the end of each day’s work, protect the open ends of all pipes against entrance of animals, children, earth, or debris by bulkheads or stoppers. Perforate bulkheads or stoppers to allow passage of water into installed pipeline so that flotation of pipeline is prevented. Remove any earth or other material that gets into piping.

B. Pipe Bedding and Haunching shall be as specified in Section 02317 - Trenching of Backfilling for Pipelines.

C. Joining

1. Clean ends of pipe laying pipe, and make each joint in a satisfactory manner in accordance with the recommendations of the manufacturer of each particular type of joint and as specified in this Section. Joint work shall be done by experienced workmen.

2. Push or pull each length of pipe “home” into bell of previously installed pipe.
   a. Push pipe by means of block and push bar. Do not use backhoe bucket, or other mechanically, electrically, or hydraulically powered excavating equipment, to join or move pipe to grade.
   b. Do not push pipe if pushing will damage pipe being installed or pipe previously installed. Where pushing will damage pipe or joint, use mechanical means consisting of cable placed inside pipe with winch, jack, or come-along to pull pipe “home”.
   c. Do not push pipe if joint gaskets are “rolled”, cut, or otherwise damaged by pushing.

3. Hold each length of pipe in place until trench and bedding are prepared for next pipe section.

D. Setting Valves and Valve Boxes

1. Clean interiors of valves of foreign matter before installation. Tighten stuffing boxes. Inspect valves in opened and closed positions to ensure parts are in working condition.

2. Set buried valves and valve boxes plumb. Center valve boxes on valves, or valve operators. Tamp backfill around each valve box to a distance of four feet on all sides of box, or to undisturbed trench face if less than four feet.
E. Installation of Tracer Tape – Install 3" wide, metalized labeled tracer tape in ditch, over piping, and 12" below finished grade. Install tracer tape in the following locations:
1. Full length of pipe.
2. End of stub outs for future connections, including, but not limited to, plugged branches of tees and wyes.
3. End of services not connected.

3.02 INSTALLATION OF EXPOSED PIPING

A. Alignment
1. Install pipe to accurate lines and grades with fittings, valves and appurtenances at locations shown on Drawings and as specified.
2. Whenever possible, install piping parallel to walls and floors.

B. Installation
1. Clean debris, dirt, and other deleterious substances out of piping before installing piping. Keep piping clean until accepted at completion of work. Do not place debris, tools, clothing, lumber, or other materials in pipe during installation.
2. Inspect pipe, fittings, valves, and appurtenances for defects prior to installation.
3. Use proper implements, tools, and facilities. Do not damage piping. Do not damage linings and coating.
4. Install piping so no undue strain is placed upon piping joints, equipment, or structures.

C. Supports
1. Provide supports necessary to hold pipe and appurtenances at lines and grades shown on Drawings.
2. Support piping so that there is no undue strain on piping joints, equipment, or structures.
3. Provide hangers and supports where required to support pipe and fittings in accordance with the manufacturers recommendations.

D. Wall Pipe and Sleeves
1. Set each wall pipe and each sleeve cast in concrete to line and elevation shown on the Drawings, ± 0.01 foot.
2. Align sleeves so that piping passes through sleeves without contacting sleeves.
3. Align wall pipe and sleeves so that joints between pipes and wall pipes, and between pipes and sleeves are water-tight.

3.03 SETTING APPURTENANCES

Install fittings, valves, hydrants, couplings, adapters, sleeves, saddles, and other piping appurtenances, in piping as indicated on the Drawings.

3.04 JOINT DEFLECTION
A. General: Deflect pipe and fittings as required to provide horizontal and vertical alignment as shown and specified. Deflection of pipe and fitting joints shall not exceed limits specified in this Section. If alignment requires joint deflections in excess of allowable deflection joint, furnish and install fittings or a sufficient number of shorter lengths of pipe.

B. Maximum Allowable Joint Deflection

1. Maximum Allowable Deflection for Ductile Iron Pipe and Fittings with ANSI/AWWA C111/A21.11 Push-on Joints shall be as specified by the push-on joint manufacturer.

   a. 4” Pipe and Fittings: 31 inches in 18 feet (8° 18’)
   b. 6” Pipe and Fittings: 27 inches in 18 feet (7° 07’)
   c. 8” through 12” Pipe and Fittings: 20 inches in 18 feet (5° 21’)
   d. 14” and 16” Pipe and Fittings: 13.5 inches in 18 feet (3° 35’)
   e. 18” and 20” Pipe and Fittings: 11 inches in 18 feet (3° 00’)
   f. 24” and 30” Pipe and Fittings: 9 inches in 18 feet (2° 23’)
   g. 36” through 48” Pipe and Fittings: 8 inches in 18 feet (2° 00’)

3.05 FLUSHING AND CLEANING
Flush and clean ductile iron piping as specified in Section 02503 - Cleaning and Flushing of Piping Systems.

3.06 HYDROSTATIC TEST
Test ductile iron piping as specified in Section 02505 - Pressure Testing of Piping Systems.

3.07 DISINFECTION
Disinfect ductile iron piping used in potable water systems as specified in Section 02507 - Disinfection of Potable Water Piping.

3.08 MANUFACTURER’S REPRESENTATIVE

A. Provide services of pipe and fitting manufacturer’s representatives as required to obtain correct piping installation, jointing, connections to structures, connections to existing piping systems, and piping supports.

B. If an epoxy pipe lining is specified, the lining material manufacturer shall provide a representative to inspect the installation, and to instruct and demonstrate to the Contractor’s personnel the procedure for field touch-up of the lining. The representative shall be at the job site a minimum of one (1) day.

END OF SECTION
PART 1 - GENERAL

1.01 SECTION INCLUDES

Requirements for materials and installation of Polyvinyl chloride (PVC) and Chlorinated polyvinyl chloride (CPVC) pipes and fittings as shown on the Drawings.

1.02 REFERENCES

A. ANSI Standards

1. ANSI B16.1 Cast Iron Pipe Flanges and Flanged Fittings, Class 125
2. ANSI B16.3 Malleable Iron Threaded Fittings, Class 150 and 300

B. ANSI/NSF

ANSI/NSF 61 Drinking Water System Components-Health Effects

C. ANSI/AWWA Standards

1. ANSI/AWWA C900 Polyvinyl Chloride (PVC) Pressure Pipe 4 In. Through 12 In. for Water Distribution

D. ASTM Standards

1. ASTM A193 Specification for Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service
2. ASTM A194 Specification for Carbon and Alloy Steel Nuts for Bolts for High-Pressure and
4. ASTM D1785 Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120
5. ASTM D2464 Specification for Threaded Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80
6. ASTM D2467 Specification for Socket-Type Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80
7. ASTM D2564 Specification for Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Pipe and Fittings
8. ASTM D3139 Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals
9. ASTM D4024 Specification for Reinforced Thermosetting Resin (RTR) Flanges
11. ASTM F439 Specification for Socket-Type Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80
12. ASTM F441 Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe, Schedules 40 and 80
13. ASTM F477 Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe

E. AWWA Standards

AWWA Manual PVC Pipe - Design and Installation

1.03 SUBMITTALS

General: As specified in Section 01330 - Materials and Equipment and Section 01330 – Submittals.

PART 2 - PRODUCTS

2.01 GENERAL

Pipe materials furnished shall follow the requirements of Section 01600 – Materials and Equipment.

2.02 MANUFACTURERS OF PVC PIPING

A. PVC (C900 and C905) pipe and fittings shall be manufactured by:

1. Certain Teed Corporation
2. The Harrington Corporation
3. Or equal US manufacturer of C900 and C905 PVC pipe and fittings.

B. PVC and CPVC (Schedule 80) pipe and fittings shall be manufactured by:

1. Eslon Thermoplastics
2. Harvel Plastics, Inc.
3. NIBCO Inc.
4. Or equal US manufacturer of Schedule 80 PVC pipe and fittings.
2.03 BURIED PVC PIPE, FITTINGS AND APPURTE\ NANCES, 4" THROUGH 36"

A. PVC Pipe 4” through 36” shall conform to ANSI/AWWA C905 and have a pressure rating of 200 psi.

B. Fittings for pipe 4” through 36” shall be ductile iron fittings as specified in Section 15122 – Ductile Iron Pipe.

C. Pipe and Fitting Joints for Buried PVC Piping, 4” through 36”
   1. Joints for buried pipe and fittings, 4” through 36” shall be restrained.
   2. Restrained joints for buried pipe and fittings, 4” through 36” shall be as follows:
      a. Restrained push-on joint, or push-on joint with restraining device.
      b. Restrained mechanical joint.

2.04 EXPOSED PVC AND CPVC PIPE AND FITTINGS AND BURIED 3" AND SMALLER PVC AND CPVC PIPE, FITTINGS, AND APPURTE\ NANCES

A. PVC and CPVC Pipe
   1. PVC pipe shall conform to the pipe standards in ASTM D1785, Schedule 80 and to the material standards in ASTM D1784, Class 12454-B.
   2. CPVC pipe shall conform to the pipe standards in ASTM F441, Schedule 80 and the material standards in ASTM D1784, Class 23447.

B. PVC and CPVC Fittings
   1. PVC fittings shall conform to ASTM D1784, Class 12454-B and the following fitting standards:
   2. CPVC fittings shall conform to ASTM D1784, Class 23447 and the following fitting standards:
      a. Socket Solvent Weld Fittings: ASTM F439
      b. Threaded Joint Fittings: ASTM F437

C. PVC and CPVC Pipe and Fitting Joints
   1. Joints for buried and above ground pipe and fittings, 3” and smaller shall be solvent socket weld, threaded or flange joint.
   2. Flanges for PVC and CPVC Pipe and Fittings, 3” and Smaller
      a. Flanges shall be of like material that conforms to ASTM D4024
b. All flanges shall have flat faces that conform to the dimension standards in ANSI B16.5, Class 150.

3. Primer for PVC and CPVC solvent socket weld pipe and fittings shall be stabilized tetrahydrofuran, or equal supplied by the pipe and fitting manufacturer.

4. Solvent Joint Cement
   a. Solvent cement for PVC shall conform to ASTM D2564
   b. Solvent cement for CPVC shall conform to ASTM F493
   c. Cement for pipe and fittings in bleach service shall be specifically approved by the manufacturer for use in sodium hypochlorite solution.
   d. Solvent cement shall be provided in containers no larger than one pint and equipped with a dauber secured to the lid.

D. Coatings for exposed PVC and CPVC Pipe and Fittings, 3” and Smaller: Coat exposed PVC pipe and fittings as specified in Division 9.

2.05 JOINT ACCESSORIES

A. Gaskets
   1. Flange joint gaskets shall be full face.
   2. Gasket Material
      b. Joints Inside of Enclosed Buildings: 1/8” neoprene or red rubber.

B. Bolts, Studs, and Nuts
   1. Bolts, Studs, and Nuts for Flange Joints
      a. Bolts for flange joints shall be semi-finished, regular hexagon head cap screws with UNC threads. The bolts shall be AISI 316 stainless steel that meets the requirements of ASTM A193, Grade B8M.
      b. Studs for flange joints shall have UNC threads and extend through the nuts a minimum of ¼”. The studs shall be AISI 316 stainless steel that meets the requirements of ASTM A193, Grade B8M.
      c. Nuts for flange joints shall be semi-finished regular hexagon nuts with UNC threads. The nuts shall be AISI 316 stainless steel that meets the requirements of ASTM A194, Grade 8M.
   2. Bolts and Nuts for Mechanical Joints
      a. Bolts for mechanical joints shall be tee-head type. The bolts shall be cast iron that meets the requirements of ANSI/AWWA C111/A21.11.
      b. Nuts for mechanical joints shall be hexagon type. The nuts shall be cast iron that meets the requirements of ANSI/AWWA C111/A21.11.
C. Threaded Joint Sealant – Sealant material for the threaded joints shall be Teflon tape, ½" wide. Tape thickness shall be as recommended by manufacturer of threaded fittings.

PART 3 - EXECUTION

3.01 INSTALLATION OF BURIED PVC PIPE

A. Laying Piping

1. Install pipe in accordance with AWWA –C605 and Section 02317 – Trenching, Bedding and Backfill for Pipe. Provide proper implements, tools, and facilities for safe and expeditious prosecution of work.

2. Lay and maintain pipe to lines shown on the Drawings, except as specified in this Section. Lay and maintain pipe to grade shown on Drawings or to minimum depth specified in this Section. Install fittings and valves in locations shown on the Drawings.

3. Where piping is to be constructed parallel to and close to existing buried utilities, the exact location of which is unknown, adjust alignment of piping to least interfere with existing buried utilities, unless otherwise shown or specified.

4. Separation of utilities and minimum depth of cover shall be as specified by local ordinance.

5. Do not lay pipe in water or when trench or weather conditions are unsuitable for proper installation.

6. Lay each pipe section in a firm foundation of bedding material.

7. Bell Holes: Excavate bell holes in advance of pipe laying so that entire barrel will bear uniformly on bedding.

8. Lower pipe, fittings, and valves into trench by hand, by means of hoists or ropes, or by other suitable tools or equipment that will not damage products, coatings, or linings. Do not drop or dump pipe, fittings, or valves into the trench.

9. Use laser beam equipment, surveying instruments, or other proven techniques to maintain accurate alignment and grade.

10. Provide piping, 3" and larger, with two short lengths of pipe, not to exceed 4 feet, for first two joints outside a building or tank wall unless a greater number of joints is shown on the Drawings.

11. Provide thrust restraint at horizontal and vertical deflection fittings and at tees, plugs, tapping sleeves, and tapping saddles as specified in ASTM D3139.

12. Properly protect open excavations at all times. At the end of each day's work, protect the open ends of all pipes against entrance of animals, children, earth, or debris by bulkheads or stoppers. Perforate bulkheads or stoppers to allow passage of water into installed pipe line so that
flotation of pipe line is prevented. Remove any earth or other material that gets into piping.

B. Pipe Bedding and Haunching shall be as specified in Section 02317 – Trenching and Backfilling for Pipelines.

C. Joining

1. Clean ends of pipe before laying pipe, and make each joint in a satisfactory manner in accordance with the recommendations of the manufacturer of each particular type of joint and as specified in this Section. Joint work shall be done by experienced workmen.

2. Push or pull each length of pipe "home" into bell of previously installed pipe.
   a. Push pipe by means of block and push bar. Do not use backhoe bucket, or other mechanically, electrically, or hydraulically powered excavating equipment, to join pipe or move pipe to grade.
   b. Do not push pipe if pushing will damage pipe being installed or pipe previously installed. Where pushing will damage pipe or joint, use mechanical means consisting of cable placed inside pipe with winch, jack, or come-along to pull pipe "home".
   c. Do not push pipe if joint gaskets are "rolled", cut, or otherwise damaged by pushing.

3. If a restrained mechanical joint or mechanical joint is required, install the joint.

4. Hold each length of pipe in place until trench and bedding are prepared for next pipe section.

D. Setting Valves and Valve Boxes

1. Clean interiors of valves of foreign matter before installation. Tighten stuffing boxes. Inspect valves in opened and closed positions to insure parts are in working condition.

2. Set buried valves and valve boxes plumb. Center valve boxes on valves, or valve operators. Tamp backfill around each valve box to a distance of four feet on all sides of box, or to undisturbed trench face if less than four feet.

E. Installation of Tracer Tape for Buried Piping: Install 3” wide labeled metalized tape in ditch, over piping, and 12” below finished grade. Install metallic tracer tape in the following locations:

1. Full length of pipe
2. End of stub outs for future connections, including, but not limited to, plugged branches of tees and wyes.
3. End of services not connected.

3.02 INSTALLATION OF EXPOSED PVC PIPING
A. **Alignment**

1. Install pipe to accurate lines and grades with fittings, valves and appurtenances at locations shown on Drawings and as specified.
2. Wherever possible, install piping parallel to walls and floors.

B. **Installation**

1. Clean debris, dirt, and other deleterious substances out of piping before installing piping. Keep piping clean until accepted at completion of work. Do not place debris, tools, clothing, lumber, or other materials in pipe during installation.
2. Inspect pipe, fittings, valves, and appurtenances for defects prior to installation.
3. Use proper implements, tools, and facilities. Do not damage piping or its linings and coating.
4. Install piping so no undue strain is placed upon piping joints, equipment, or structures.

C. **Supports**

1. Provide supports necessary to hold pipe and appurtenances at lines and grades shown on Drawings
2. Support piping so that there is no undue strain on piping joints, equipment, or structures.
3. Provide hangers and supports where required to support pipe and fittings in accordance with manufacturer’s recommendations.

3.03 **SETTING APPURTENANCES**

A. Install fittings, valves, hydrants, couplings, adapters, sleeves, saddles, and other piping appurtenances, in piping as indicated on the Drawings.

3.04 **JOINT DEFLECTION**

A. **General**

1. Deflect pipe and fittings as required to provide horizontal and vertical alignment as shown and specified.
2. Deflection of pipe and fitting joints shall not exceed limits specified in this Section. If alignment requires joint deflections in excess of allowable deflection joint, furnish and install fittings or a sufficient number of shorter lengths of pipe.

B. **Maximum Allowable Joint Deflection** - maximum joint deflection shall be as specified maximum by the pipe manufacturer or the restrained joint manufacturer.

3.05 **FLUSHING AND CLEANING**
A. Flush and clean PVC and CPVC piping used for potable water, wastewater, sludge or reclaimed water as specified in Section 02503 - Cleaning and Flushing of Piping Systems.

B. Purge PVC and CPVC used for chemical piping with dry compressed air (DCA) or nitrogen (N) as indicated in the following table:

<table>
<thead>
<tr>
<th>Service</th>
<th>Purge Gas</th>
<th>Dew Point</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alum</td>
<td>DCA</td>
<td>-40° F</td>
</tr>
<tr>
<td>Chlorine Gas</td>
<td>N</td>
<td>-40° F</td>
</tr>
<tr>
<td>Chlorine Solution</td>
<td>DCA</td>
<td>-40° F</td>
</tr>
<tr>
<td>Polymer</td>
<td>DCA</td>
<td>-40° F</td>
</tr>
<tr>
<td>Polymer Solution</td>
<td>DCA</td>
<td>-40° F</td>
</tr>
<tr>
<td>Sample</td>
<td>DCA</td>
<td>-40° F</td>
</tr>
<tr>
<td>Sodium Hydroxide</td>
<td>DCA</td>
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</tr>
<tr>
<td>Sulfur Dioxide Gas</td>
<td>N</td>
<td>-40° F</td>
</tr>
<tr>
<td>Sulfur Dioxide Solution</td>
<td>DCA</td>
<td>-40° F</td>
</tr>
</tbody>
</table>

3.06 HYDROSTATIC TEST

Test PVC and CPVC piping as specified in Section 02505 - Pressure Testing of Piping Systems.

3.07 DISINFECTION

A. Disinfect PVC pipe used in potable water systems as specified in Section 02507 – Disinfection of Potable Water Piping.

3.08 MANUFACTURERS’ REPRESENTATIVE

A. Provide services of pipe and fitting manufacturers’ representatives as required to obtain correct piping installation, jointing, connections to structures, connections to existing piping systems, and piping supports.

B. Provide assistance of pipe and fitting manufacturers’ representatives at no additional cost to the Owner.

END OF SECTION
SECTION 15125

HOUSEKEEPING PADS, CONCRETE

PART 1 -- GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SCOPE

A. Provide concrete housekeeping pads for all equipment. This work shall be performed by the concrete installer.

1.03 RELATION TO OTHER WORK

A. Refer to the section, "General Mechanical Provisions", for related requirements. Refer to other sections of Division 15 and to all other applicable portions of the drawings and specifications.

B. This section directly related in particular to sections (which may or may not be included in this division) which describe concrete in other divisions.

PART 2 -- PRODUCTS

2.01 GENERAL

A. All concrete and steel for concrete housekeeping pads shall comply with those sections of the specification division describing concrete and steel.

2.02 HOUSEKEEPING PADS

A. Provide reinforced (#4’s @ 8” both ways with 1-1/2” top cover and #4 dowels at 8” o.c. unless noted otherwise) concrete housekeeping pads for each individual machine. Pads shall extend four inches beyond the machine bases in all directions and be continuous beneath the machine. Pads shall have chamfered edges and shall be poured and finished smooth and level to insure proper and continuous support for the bearing surfaces of the machine.

B. Coordinate exact length and width of each pad and any penetrations that may be necessary for piping or conduit with the actual equipment approved for use on the project.

PART 3 -- EXECUTION

3.01 GENERAL
A. Refer to the section describing vibration isolation for equipment which is to rest on concrete housekeeping pads.

3.02 PAD HEIGHTS

A. Provide 4" high concrete pads for the following:

1. All equipment specified or shown to be on a concrete pad if no height is given.
2. Air handlers.

END OF SECTION
SECTION 15142
STAINLESS STEEL PIPE

PART 1 - GENERAL

1.01 SECTION INCLUDES

Stainless steel piping system products specified in this Section and shown on the Drawings.

1.02 REFERENCES

A. General: As specified in Section 01420 - Reference Standards.

B. ANSI Standards

1. ANSI B16.1 Cast Iron Pipe Flanges and Flanged Fittings, Class 125
2. ANSI B16.3 Malleable Iron Threaded Fittings, Class 150 and 300
3. ANSI B16.5 Pipe Flanges and Flanged Fittings, Steel Nickel Alloy and Other Special Alloys

C. ANSI/ASME

ANSI/ASME Stainless Steel Pipe B36.19M

D. ANSI/NSF

ANSI/NSF 61 Drinking Water System Components-Health Effects

E. ASTM Standards

1. ASTM A182 Specification for Forged or Rolled Alloy-Steel Pipe Flanges, Forged Fittings, and Valves and Parts for High Temperature Service
2. ASTM A193 Specification for Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service
3. ASTM A194 Specification for Carbon and Alloy Steel Nuts for Bolts for High-Pressure and High-Temperature Service
4. ASTM A312 Specification for Seamless and Welded Austenitic Stainless Steel Pipe
5. ASTM A351 Specification for Steel Castings, Austenitic, for High Temperature Service
6. ASTM A403 Specification for Wrought Austenitic Stainless Steel Pipe Fittings
7. ASTM A774 Specification for As-Welded Wrought Austenitic Stainless Steel Fittings for General Service at Low and Moderate Temperatures
8. ASTM A778 Specifications for Welded, Unannealed Austenitic Stainless Steel Tubular Products.

1.03 SUBMITTALS
A. General: As specified in Section 01330 - Submittals

1.04 QUALITY ASSURANCE

A. Testing: Test pipe, fittings, and water piping appurtenances specified in this Section.

PART 2 – PRODUCTS

2.01 General

A. Piping, fittings and accessories furnished under this section shall be in accordance with the requirements of Section 01600 – Material and Equipment.

2.02 MANUFACTURERS OF STAINLESS STEEL PIPE AND FITTINGS

A. Stainless steel pipe shall be manufactured by:
   1. Armco Stainless Steel Division
   2. Carpenter Technology
   3. Douglas Brothers
   4. Felker Brothers Corporation

B. Stainless Steel fittings shall be manufactured by:
   1. Camco Fitting Company
   2. Douglas Brothers
   3. Felker Brothers Corporation
   4. Flowline

2.03 STAINLESS STEEL PIPE, FITTINGS, AND APPURTENANCES, 4” THROUGH 36”

A. Pipe 4” through 36” shall be AISI 304L, UNS S30403 stainless steel that conforms to ASTM A312 or A778, Grade. Pipe dimensions and wall thickness shall conform to ANSI/ASME B36.19M, Schedules 10S

B. Fittings for 4” through 36” pipe shall be AISI 304L, UNS S31603 stainless steel that conforms to ASTM A312 or ASTM A774. Fitting dimensions and wall thickness shall conform to ANSI/ASME B 316.9M, Schedule 10S.

C. Joints for Buried piping
   1. Buried pipe and fittings shall have welded joints.

D. Joints for exposed piping
   1. Joints for exposed piping shall be flanged or welded.
   2. Flanges shall be AISI 304L stainless steel, UNS S31603 that conforms to ASTM A182. Flange dimensions shall conform to ANSI B16.5, Class 150.
   3. Flange shall be welded neck, or slip-on type with 1/16” raised face.
2.04 STAINLESS STEEL PIPE, FITTINGS, AND APPURTENANCES, 3” AND SMALLER

A. Pipe

1. Pipe conform shall be AISI 316L, UNS S31603 stainless steel that conforms to ASTM A312.
2. Pipe dimensions and wall thickness shall conform to ANSI/ASME B36.19M, Schedule 40S.

B. Fittings

1. Fittings shall conform shall be AISI 316L stainless steel.
2. Fittings shall conform to the following for forged/wrought and cast fittings:
   a. Forged/Wrought Stainless Steel Fittings: ASTM A182, Grade 316L.
   b. Cast Stainless Steel Fittings: ASTM A351, Grade CF8M.
   c. Fitting dimensions shall conform to ANSI B16.3, Class 150.

C. Joints for Exposed Stainless Steel Pipe

1. Joints for exposed stainless steel pipe shall be threaded or flange.
2. Flanges shall be made of AISI 316L, UNS S31603 stainless steel.
3. Flange Standard for Stainless Steel Flanges, 3” and Smaller: ASTM A182.
5. Flange Type for Stainless Steel Flanges, 3” and Smaller: Threaded or welding neck.
6. Face Type for Stainless Steel Flanges, 3” and Smaller: 1/16” raised face.

2.05 JOINT AND COUPLING ACCESSORIES

A. Gaskets

1. Flange Joint Gaskets
   b. Gaskets for Stainless Steel Piping: Ring.

2. Gasket Material
   b. Joints Inside of Enclosed Buildings: 1/8” neoprene or red rubber.


5. Union and Strainer Gaskets: Viton.

B. Bolts, Studs, and Nuts

1. Bolts, Studs, and Nuts for Flange Joints
   a. Bolts for flange joints shall be semi-finished, regular hexagon head cap screws with UNC threads. The bolts shall be AISI 316 stainless steel that meets the requirements of ASTM A193, Grade B8M.
   b. Studs for flange joints shall have UNC threads and extend through the nuts a minimum of ¼”. The studs shall be AISI 316 stainless steel that meets the requirements of ASTM A193, Grade B8M.
   c. Nuts for flange joints shall be semi-finished regular hexagon nuts with UNC threads. The nuts shall be AISI 316 stainless steel that meets the requirements of ASTM A194, Grade 8M.

2.06 STRAINERS

A. Stainless Steel "Y" Strainers

1. Manufacturer and Model
   a. Hayward Model 80, Watts 88S Series or equal stainless steel "Y" strainers by US manufacturer.

2. Body
   b. Standard: ASTM A351, Grade CF8M
   d. Inlet and Outlet Connections: Threaded, NPT.
   e. Flushing Connection: Threaded, NPT.

3. Screen
   b. Perforations: 20 mesh.

PART 3 - EXECUTION

3.01 INSPECTION

A. Quality of materials, process of manufacture, and finished products shall be subject to inspection and approval by Engineer. Such inspection may be made at place of manufacture or at project site after delivery, or at both places. Products shall be subject to
rejection at any time on account of failure to meet any of the specified requirements even though sample products have been accepted as satisfactory at place of manufacture.

B. Inspect pipe, fittings and piping appurtenances prior to installation. Reject and promptly remove pipe, fittings, valves, and piping appurtenances that do not meet the Specifications. Remove rejected products from the job site.

3.02 GENERAL INSTALLATION

A. Install pipe, fittings and piping appurtenances in accordance with the requirements of the applicable Sections of Division 2 and as specified in this Section.

B. Install piping to lines, grades, elevations, or lines, grades and elevations shown on Drawings. Install piping with continuous grade between elevations shown on Drawings. Provide additional grade changes as required to avoid interferences and as required to provide separation distances specified in this Section. Make changes in directions or elevations with fittings, by deflecting pipe joints, or with fittings and deflecting pipe joints.

C. Clean pipe, fittings and piping appurtenances before and during installation.

D. Before setting wall sleeves, pipes, castings and pipes to be cast in place, check the Drawings and equipment manufacturer's drawings that may have a direct bearing on pipe locations. Properly locate pipe, fittings, valves, and appurtenances during construction of and renovation of tanks and structures.

E. Attach piping to pumps and other equipment in accordance with respective manufacturers' recommendations. Use flexible connectors where required to prevent excess load, vibration, or load and vibration on pumps and other equipment.

F. Support pipe, fittings, valves, and piping appurtenances in accordance with requirements as shown.

G. Do not damage pipe, fittings and piping appurtenances during installation. Remove and replace damaged pipe, fitting, valves, or piping appurtenances. Remove damaged products from job site. Remove and replace damaged products at no additional cost to Owner.

H. Do not cut pipe by burning. Cut pipe with a saw, cutter, or abrasion. Use the proper tool, machine, or tool and machine for each pipe material. Examine cut ends for damage caused by cutting. Bevel cut ends of pipe.

3.03 INSTALLATION OF BURIED PIPE

A. Laying Piping

1. Provide proper implements, tools, and facilities for safe and expeditious prosecution of Work.

2. Lay and maintain pipe to lines shown on the Drawings, except as specified in this Section. Lay and maintain pipe to grade shown on Drawings or to minimum depth specified in this Section. Install fittings and valves, in locations shown on the Drawings.
3. Where piping is to be constructed parallel to and close to existing buried utilities, the exact location of which is unknown, adjust alignment of piping to least interfere with existing buried utilities, unless otherwise shown or specified.

4. Lay pressure piping to a depth so that not less than 2'-6" of cover is provided, unless otherwise shown. Cover shall be vertical distance from top of the pipe to finish grade elevation.

5. Do not lay pipe in water or when trench or weather conditions are unsuitable for proper installation.

6. Lower pipe, fittings, and valves into trench by hand, by means of hoists or ropes, or by other suitable tools or equipment that will not damage products, coatings, or linings. Do not drop or dump pipe, fittings, or valves into the trench.

7. Use laser beam equipment, surveying instruments, or other proven techniques to maintain accurate alignment and grade.

8. Provide piping, 3" and larger, with two short lengths of pipe, not to exceed 4 feet, for first two joints outside a building or tank wall unless a greater number of joints is shown on the Drawings.

9. Provide thrust restraint at horizontal and vertical deflection fittings and at tees, plugs, tapping sleeves, and tapping saddles as specified in this Section.

10. Properly protect open excavations at all times. At the end of each day's work, protect the open ends of all pipes against entrance of animals, children, earth, or debris by bulkheads or stoppers. Perforate bulkheads or stoppers to allow passage of water into installed pipe line so that flotation of pipe line is prevented. Remove any earth or other material that gets into piping.

B. Pipe Bedding and Haunching

1. General
   a. Lay each pipe section in a firm foundation of bedding material
   b. Haunch and backfill pipe so that piping is properly supported, line and grade of piping is not changed, piping is not damaged and coating and encasement is not damaged.
   c. Use material from excavation for bedding when excavated material meets gradation requirements specified in Section 02317 - Trenching and Backfilling for pipe bedding material.
   d. Prior to pipe installation, bring bedding material to grade along entire length of pipe to be installed. Provide support for pipe by the following procedures:
      (1) Provide uniformly compacted bedding. Excavate bedding material or place the bedding material above pipe bottom so that bedding grade is correct following compaction of bedding. Use hand or mechanical tamping to compact bedding material to a minimum of 95 percent of bedding material's Modified Proctor Maximum Dry Density.
      (2) Control moisture content of bedding so that specified compaction is achieved. Dewater trenches as required to maintain dry trench or trenches, and control moisture content of pipe bedding. Add water to bedding if moisture in bedding is deficient. If additional water is required to achieve
specified compaction, control addition of water so that specified compaction is achieved.

(3) Check grade of bedding after compaction.

e. Provide bedding as detailed on Drawings.

2. Yielding Subsoil

a. In yielding subsoil, undercut trench bottom to the depth necessary to achieve stable bedding.

b. Backfill trench bottom with foundation material as specified in Section 02317 - Trenching and Backfilling and as follows:

(1) Screened gravel for pipe smaller than 24”.

(2) Crushed stone for pipe 24” and larger.

c. Stabilize yielding subsoil at no additional cost to Owner.

3.04 INSTALLATION OF EXPOSED PIPING

A. Alignment

1. Install pipe to accurate lines and grades with fittings, valves and appurtenances at locations shown on Drawings and specified.

2. Wherever possible, install piping parallel to walls and floors.

B. Installation

1. Clean debris, dirt, and other deleterious substances out of piping before installing piping. Keep piping clean until accepted at completion of work. Do not place debris, tools, clothing, lumber, or other materials in pipe during installation.

2. Inspect pipe, fittings, valves, and appurtenances for defects prior to installation.

3. Use proper implements, tools, and facilities. Do not damage piping. Do not damage linings and coating.

4. Install piping so no undue strain is placed upon piping, equipment, or structures.

C. Supports

1. Provide supports necessary to hold pipe and appurtenances at lines and grades shown on Drawings

2. Support piping so that there is no undue strain on piping, equipment, or structures.

3. Provide hangers and supports as shown.

D. Wall Pipe and Sleeves

1. Set each wall pipe and each sleeve cast in concrete to line and elevation shown on Drawing, ±0.01 foot.

2. Align sleeves so that piping passes through sleeves without contacting sleeves.
3. Align wall pipe and sleeves so that joints between pipes and wall pipes and between pipes and sleeves are water-tight.

3.05 SETTING APPURTEANCES

Install fittings, valves, couplings, sleeves, saddles, and other piping appurtenances, in piping as indicated on the Drawings.

3.06 CONNECTING TO EXISTING PIPE

A. General

1. Locate existing pipe horizontally and vertically and verify exact size of existing pipe.
2. Locate existing pipe sufficiently in advance of making connections to allow ample time for making changes in connection location and size.

B. Dry Connections

1. Make each dry connection with fittings and valves indicated on Drawings.
2. Provide sleeves required to complete connections.
3. Required pipe, fittings, valves, tools, and equipment shall be at connection site prior to starting connection.
4. Make connections at night and on weekends when existing piping can only be removed from service during minimum flow periods.
5. Owner will operate existing valves.
6. Inspect piping and eliminate leaks immediately after connection is completed and existing pipe is put in service.

3.07 THRUST RESTRAINT FOR BURIED PIPING

A. Restraint for Pipe and Fittings

1. Restrain pipe joints in all directions from change of direction.
2. Where piping enters structures provide restrained joint wall pipe at structure.
3. Restrain valves, couplings, adapters, and other piping appurtenances located near changes in direction.
4. Restrain valves so that unbalanced force developed during opening and closing of valves are supported independent of the piping system.

3.08 THRUST RESTRAINT FOR EXPOSED SLEEVES AND COUPLINGS

A. General

1. Restrain sleeves and couplings in exposed piping if piping is not secured by anchors or structures.
2. Restraint of sleeves and couplings in exposed piping is not required if piping is secured by anchors, structures, or anchors and structures.
B. Restraint for Sleeve Type Couplings and Flange Adapters

1. Restrain sleeve type couplings with harness of tie rods that span across coupling, as shown on Drawings.
2. Where distance between adjacent flanges is in excess of ten feet or where harness cannot be used due to obstructions or other conditions, provide pipe supports adjacent to coupling. Provide supports adjacent to couplings that prevent linear or angular movement that results in pipe separating from the coupling or misalignment in coupling joints.
3. Tie rods and nuts shall be AISI Type 316 stainless steel.

C. Restraint for Flexible Pipe Couplings

1. Provide control units for flexible pipe couplings.
2. Install tie rods and control in accordance with the manufacturer’s recommendations.

3.10 HYDROSTATIC TEST

A. Test water piping as specified in Section 02505 – Pressure Testing of Piping Systems.

3.11 FLUSHING AND CLEANING

A. Flush and clean water piping as specified in Section 02503 – Cleaning and Flushing of Piping Systems.

3.12 MANUFACTURERS’ REPRESENTATIVE

A. Provide services of pipe and fitting manufacturers’ representatives as required to obtain correct piping installation, jointing, connections to structures, connections to existing piping systems, and piping supports.

B. Provide assistance of pipe and fitting manufacturers’ representatives at no additional cost to the Owner.

END OF SECTION
SECTION 15190
VIBRATION ISOLATION EQUIPMENT - GENERAL

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SCOPE

A. Provide vibration isolation supports for all equipment and piping as may be required to prevent transmission of vibration to building structure. This shall include air handling units, fans and similar items.

1.03 RELATION TO OTHER WORK

A. Refer to the section, "General Mechanical Provisions", for related requirements. Refer to other sections of the Division 15 and to all other applicable portions of the drawings and specification.

1.04 SHOP DRAWINGS

A. Refer to Section entitled "General Mechanical Provisions". Submittal data shall show type, point loading information, size and deflection of each isolator proposed and any other information as may be required for the Architect/Engineer to check isolator selections for compliance with specifications. Include clearly outlined procedures for installing and adjusting the isolators.

1.05 MANUFACTURERS

A. Products of the following manufacturers will be acceptable, provided they comply with all of the requirements of this specification: Consolidated Kinetics; Mason Industries; Amber-Booth; Keflex; Flexonics; Vibration Eliminator Company or equivalent. Any model numbers listed are from one or more of these manufacturers and are given to provide an example of item(s) required.

1.06 OTHER REQUIREMENTS

A. All vibration isolation equipment shall be both recommended by the manufacturer and approved by the Architect/Engineer for each particular application on this project.

PART 2 -- PRODUCTS

2.01 BASIC REQUIREMENTS
A. Unless otherwise noted, neoprene vibration isolators shall be used for all equipment. It shall be the responsibility of isolation manufacturer to determine the amount of deflection required for each isolator to achieve optimum performance, prevent the transmission of objectionable vibration and meet noise criteria referenced herein.

PART 3 -- EXECUTION

3.01 GENERAL

A. All isolators shall be installed in strict accordance with the manufacturer’s instructions and shall be properly adjusted prior to requesting final inspection or the performance of any vibration testing specified.

B. Each item of equipment (machinery, piping, etc.) which is provided with vibration isolation equipment shall rest in its intended, proper operating position (i.e; exactly level, etc.) after installation of vibration isolation equipment. Approval of such vibration isolation equipment by Engineer shall not relieve the Contractor of this responsibility.

END OF SECTION
SECTION 15210
PIPE AND FITTINGS – PLUMBING, HVAC AND FIRE PROTECTION

PART 1 - GENERAL

1.01 WORK INCLUDES

A. Contractor provide:
   1. Pressurized piping.
   2. Nonpressurized piping.
   3. Accessories:
      1) Dielectric waterway fittings.

1.02 QUALITY ASSURANCE

A. Pipe and fittings to be ASTM labeled for rating specified.

1.03 SUBMITTALS (See Division 1)

A. Product data: Pipe and fittings.

PART 2 - PRODUCTS

2.01 GENERAL

A. Acceptable manufacturers:
   1. PVC plastic pipe:
      a. Plastiline, Inc.
      b. Dupont.
      c. R & G Sloane.
      d. Manville.
      e. CertainTeed Corp.
      f. Clow Corp.
      g. Tyler Co.
   2. Fittings, mechanical grooved pipe:
      a. Victaulic Company of America.
      b. Grinnell Corp.
      c. Guston-Bacon.
   3. Dielectric waterway fittings:
      a. Victaulic Company of America.
   4. Other manufacturers desiring approval comply with the Contract Documents.

2.02 PIPE

A. Black steel pipe:
   1. For fire sprinkler service: ASTM-A53, Grade B, Schedule 40 or Schedule 10, 20,
or 30 with minimum 0.25 inch wall thickness.

B. Copper pipe:
   1. Seamless copper tubing, ASTM-B88 or F.S.WW-T-799E, type K, L or M as indicated.
   2. Soldered joints: Use ASTM-B32, 95 percent tin, 5 percent antimony solder, or Silvabrite 100.

C. PVC plastic pipe:
   1. ASTM-D1785, Schedules 40, 80, 120 as indicated.
   2. Socket type PVC fittings: ASTM-D2466 or ASTM-D2467, Schedule 40 and Schedule 80, long radius patterns.
   3. Threaded type PVC fittings: ASTM-D2464, threaded, Schedule 80, long radius patterns.
   4. Do not thread Schedule 40 pipe.

2.03 FITTINGS AND COUPLINGS

A. Copper pipe fittings:
   3. Flared tubing fittings: Use only on annealed pipe.

B. Steel pipe fittings:

C. Malleable iron pipe fittings:
   1. Threaded fittings: ANSI/ASME-B16.3, 150 PSI.
   2. Threaded couplings:
   4. Galvanized malleable iron couplings: Victaulic; or ITT Grinnell.

D. PVC plastic pipe fittings:
   1. Socket type: ASTM-D2466 or ASTM-D2467, Schedule 40 and 80, long radius patterns.
   2. Threaded type: ASTM-D2464, Schedule 80, long radius patterns.
   3. Same pressure and temperature rating as pipe.

E. Dielectric waterway fittings:
   1. ASTM-A53 Schedule 40, hot dip galvanized, steel pipe casing with inert, non-corrosive thermoplastic lining (NSF/FDA listed).
   2. Threaded or threaded X rolled grooved connections.
   3. Victaulic, "Clearflow".

F. Mechanical grooved end couplings and fittings:
   1. Malleable iron, ASTM-A47 or ductile iron, ASTM-A536.
   2. Gaskets: EPDM Grade E conforming to ASTM-D2000 for water services up to 230 deg. F.
PART 3 - EXECUTION

3.01. GENERAL

A. Comply with ANSI/ASME-B31.9 for pressure piping installations.

B. Flush out water piping systems with clean water.

C. In general, make connections to components in piping systems with 3-elbow swing joints to allow for movement.
   1. Movement includes but not limited to expansion, contraction and equipment vibration isolation.

3.02. PIPING

A. Install piping parallel to building walls at such heights as not to obstruct portion of window, doorway, stairway, or passageway.
   1. Where interference develops in field, offset or reroute piping as required to clear such interferences.
   2. Consult Drawings for exact location of pipe spaces, ceiling heights, door and window openings or other architectural details and report discrepancies to Engineer/Architect, before installing piping.

B. Pitch piping to drain:
   1. Minimum pitch of 1 inch in 100 feet (except drainage piping).
   2. Make piping and equipment drainable.
   3. Accomplish pipe drainage using drain valves located on equipment and fixtures or separate drains.

C. Factory cut and thread nipples from seamless stock.
   1. Use nipples of same material as pipe with which they are used.
   2. Do not use close nipples except where such use is unavoidable.
   3. Use Schedule 80 seamless pipe for close nipples and nipples of pipes 3/8 inch or smaller.

D. Provide backing and sleeves required in walls or floors for setting of fixtures or equipment.

E. Where transition occurs from sweated fittings (as at connection to fixture supplies, etc.), provide rigid anchorage so that no strain will be placed upon tubing.

3.03. JOINTS

A. Threaded joints:
   1. Cut piping carefully, ream, thread and work into place without springing.
   2. Use a small amount of prepared pipe thread lubricant on outside threads only.

B. Use dielectric waterway fittings for connections between dissimilar metals.

C. Flanged joints:
   1. Take care to ensure that there is no restraint on opposite end of pipe or fittings
which would prevent uniform gasket compression or cause unnecessary stress in flanges.

2. Keep one flange free to move in any direction while flange bolts are being tightened.

3. Do not pack or assemble bell and spigot joints affected by flanged joints until such flanged joints have been tightened.

4. Tighten bolts gradually and at a uniform rate, so that gasket compression is uniform over entire area of gasket.

D. Mechanical joints:
   1. Assemble in accord with instructions and recommendations of pipe manufacturer.
   2. Clean joint surfaces and lubricate with soap solution or water soluble lubricant immediately before joint is assembled.

3.04. UNIONS

A. Provide a union between valves, at connection to each fixture, device or item of equipment, and elsewhere as required to make up or disconnect piping.
   1. Install each union to facilitate removal of parts, equipment or fixtures for inspection or cleaning.
   2. Install in a position which will permit device, fixture or part to be removed without disconnecting piping except unions.

B. Install unions elsewhere in system as required to facilitate installation and servicing.

C. Provide unions as specified in Section 15220.

3.05. THREADED STEEL PIPING

A. Branch connections to screwed piping may be made with Weld-O-Lets or Thread-O-Lets.

B. Do not weld pipe couplings in place of welding fittings for branch connections.

3.06. COPPER PIPING

A. Do not use solder containing lead.

3.07. PVC PIPING

A. Make pipe cuts only with miter box.
   1. Make cuts square and straight with pipe centerline.
   2. Use fine toothed hand wood saw with 14 or more points per inch.
   3. After cutting, slightly ream pipe inside and remove external burrs.

B. Chemical welding:
   1. Perform in strict accord with manufacturer’s recommendations.
   2. Comply with ASTM-D2855.
   3. Clean both pipe and fitting contact areas with recommended cleaner.
   4. Apply cement lightly to both pipe and fitting and slide fitting on to pipe with one continuous motion and at proper time.
   5. Rotate fitting lightly to distribute cement.
   6. Wipe off excess cement.
7. Deliver cement for chemical welding to job site in sealed pint containers and keep covered at all times when not in use.
8. Do not dilute, thin or alter cement.
9. Use only cement recommended by pipe manufacturers.

END OF SECTION
PART 1 - GENERAL

1.01. WORK INCLUDES

A. Contractor provide:
   1. Thermometers and pressure gauges.
   2. Air vents.
   3. Unions.
   4. Drains.

1.02. QUALITY ASSURANCE

A. Comply with UL, ANSI or ASTM Standards.

1.03. SUBMITTALS (See Division 1)

A. Product data.

PART 2 - PRODUCTS

2.01. MATERIALS

A. Acceptable manufacturers:

   1. Pressure gauges:
      a. Ashcroft.
      b. Marsh Instrument Co.
      c. Miljoco.
      d. U S Gauge.
      e. Weiss Instruments.
      f. Weksler Instruments Corp.
      g. Weston and Ernst.

   2. Thermometers:
      a. Ashcroft.
      b. Marshalltown Instrument Inc.
      c. Marsh Instrument Co.
      d. Miljoco.
      e. Palmer Instruments.
      f. Taylor Scientific Instruments.
      g. Weiss Instruments.
      h. Weksler Instruments Corp.
      i. Weston and Ernst.
3. Manual air vents:
   a. Crane.
   b. Jenkins.
   c. Johnston Corp.
   d. OIC.
   e. Powell.
   f. Stockham.
   g. Walworth.

4. Automatic air vents:
   a. Armstrong.
   b. Spirax Sarco Inc.
   c. Illinois.
   d. Trane.
   e. Hoffman.
   f. Bell & Gossett.
   g. Thrush.
   h. Taco.
   i. Fisher.
   j. Johnston Corp.

5. Other manufacturers desiring approval comply with Division 1.

2.02. THERMOMETERS

   A. Column Thermometers:  Industrial type, with separable brass sockets, red reading mercury free with 9 inch scale minimum, black lines and numbers, right or left side angle type and shatterproof glass.

   1. Thermometers range schedule:

<table>
<thead>
<tr>
<th>Range (deg. F)</th>
<th>Division (deg. F)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Domestic hot water</td>
<td>30-180</td>
</tr>
<tr>
<td>Domestic cold water</td>
<td>0-100</td>
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<tr>
<td>Heating hot water</td>
<td>50-300</td>
</tr>
<tr>
<td>Condensate pump disc</td>
<td>50-300</td>
</tr>
<tr>
<td>Compressed air</td>
<td>50-300</td>
</tr>
<tr>
<td>LP steam</td>
<td>50-300</td>
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<tr>
<td>Boiler feed water</td>
<td>50-300</td>
</tr>
<tr>
<td>Blow down</td>
<td>50-400</td>
</tr>
<tr>
<td>Fuel oil</td>
<td>50-400</td>
</tr>
<tr>
<td>Chilled water at coils</td>
<td>30-130</td>
</tr>
<tr>
<td>Chilled water at pumps and chiller</td>
<td>0-100</td>
</tr>
<tr>
<td>Condenser water</td>
<td>0-100</td>
</tr>
</tbody>
</table>
B. Dial Thermometers: 6" stainless steel case, with 12" bendable extension, 20 ft. line length, temperature range 20° to 240° F.

2.03. PRESSURE GAUGES

A. Pressure gauges shall be as specified in Section 15114.

2.04. AIR VENTS

A. Air vents, manual:
   1. Vent valves: 1/4 inch 125 PSI globe angle valve with XH nipple connecting to pipe.

B. Air vents, automatic:
   1. 150 PSI rated, minimum.
   2. Maximum working pressure: 45 PSIG.
   3. Maximum working pressure: 100 PSIG.
   4. Maximum temperature: 212 deg. F.
   5. Cast bronze, chrome plated, body with renewable valve and seat.
   6. Synthetic rubber disc.

2.05. UNIONS

A. Unions: Of same type, pressure rating and material as piping.

B. Flanges: Raised face type of same type, pressure rating and material as piping.

C. Unions in copper pipe:
   1. 2 inch and smaller: Use wrought copper solder joint copper to copper unions.
   2. 2-1/2 inch and larger: Use brass flange unions.

D. Dielectric unions: Standard products for prevention of galvanic corrosion.

2.06. DRAINS

A. Drains: 3/4 inch stainless steel ball valve or as indicated on drawings.

B. Access panels: Provide flush access panel where drains occur in concealed piping.

PART 3 - EXECUTION

3.01. GENERAL

A. Install piping specialties according to manufacturer instructions and as specified.

3.02. THERMOMETERS

A. Where temperature control requires a temperature transmitter, a thermometer will not be required in same location unless specifically required in equipment specifications.
B. Where 2 or more pumps are headered, provide one thermometer in suction header and one in discharge header.

C. Adjust faces of thermometer to proper angle for best visibility.

D. Clean windows of thermometer and clean factory-finished surfaces. Replace cracked and broken windows, and repair scratched and marred surfaces with manufacturer's touchup paint.

3.03. PRESSURE GAUGES

A. Where required, install stainless steel hard tempered tubing from gauge to pipe connection.

B. Calibrate and zero gauges at job site.

C. Adjust faces of gauges to proper angle for best visibility.

D. Clean windows of gauges and clean factory-finished surfaces. Replace cracked and broken windows, and repair scratched and marred surfaces with manufacturer's touchup paint.

3.04. AIR VENTS

A. Air vents, manual:
   1. Provide vents to prevent ANY part of system from being air bound.
   2. Pipe discharge of vent to a location where air and water may be collected in a bucket.
   3. Provide at trapped high points of cooling and heating piping systems whether or not indicated.

B. Air vents, automatic:
   1. Provide shut off valve ahead of vent.
   2. Provide copper relief line from valve to drain or drip pan.
   3. Provide at each water heater.

3.05. UNIONS

A. Install unions as directed by Fluid Controls Institute, Inc., (FCI).
   1. Make connections between couplings and flanged equipment with slip-on flanges and a grooved nipple, or "Vic-Flange" adapter.

B. Flanged connections:
   1. Where flanged valves are used at equipment connections, flange unions will not be required.

C. Install dielectric unions at each piping joint and equipment connection between ferrous and non-ferrous materials.

3.06. DRAINS
A. Provide drain valves to drain piping systems and drain safety valves.
   1. For draining low points of piping: Minimum 6 inch nipple, with ball valve.
   2. On piping 2-1/2 inch and larger: Ball valve with hose adapter. On piping 2 inch and smaller: Ball valve.

B. Drains from safety valves:
   1. Provide at safety valves, where discharge is infrequent, or valves which have test levers.
   2. Pipe to Floor drain.

C. Drains on copper piping: Male iron pipe adapter and threaded brass cap except where valve drains are required.

D. Access panels: Provide flush access panel where drains occur in concealed piping.

E. All drains piped to floor drains shall terminate over the grated portion of the floor drain.

END OF SECTION
SECTION 15225
SPECIAL MECHANICAL REQUIREMENTS –
PLUMBING, HVAC AND FIRE PROTECTION

PART 1 - GENERAL

1.01 WORK INCLUDES

A. Contractor to furnish and install all materials and provide labor required to provide a complete, operable and acceptable installation as shown on the Contract Documents.

1.02 QUALITY ASSURANCE

A. Perform work in accord with the latest editions of the following codes:
   1. State and City Building, Plumbing, Mechanical and Energy codes.
   4. Authorities having jurisdiction.

B. Drawings use and interpretation:
   1. Drawings are diagrammatic and indicate general arrangement of systems and equipment, except when specifically dimensioned or detailed.
   2. Follow Contract Drawings in laying out the work. Check and be familiar with Shop Drawings and Coordination Drawings affecting spaces in which the work will be installed.
   3. For locations of building elements, refer to dimensioned architectural/structural drawings.
   4. Field measurements take precedence over dimensioned drawings.
   5. Piping and ductwork plans are intended to show size, capacity, approximate location, direction and general relationship of one work element to another, but not exact detail or arrangement.
   6. Provide fittings, offsets, etc. as may be required to suit field conditions.
   7. Dimensions indicated are limiting dimensions.

C. Installation of systems and equipment is subject to clarification as indicated in submittals, Coordination Drawings, and interpretations.

D. Description of systems:
   1. Provide materials to provide functioning systems in compliance with performance requirements specified.
   2. Provide modifications required by submittals.

1.03 SUBMITTALS (See Division 1)

A. Shop drawings: Not required for Engineer/Architect review.
B. Product data: Access doors.

C. Samples: Not required for Engineer/Architect review.

D. Project information: Not required for Engineer/Architect review.

E. Contract closeout information: Not required for Engineer/Architect review.

1.04 PROTECTION

A. Provide covering and shielding for equipment provided to protect from damage.

B. Repair, restore and replace damaged items.

C. Protect nameplates on motors, pumps and similar equipment.

D. Protect plumbing fixtures and brass or chromium plated trim, valves and piping from damage.

E. Keep dirt and debris out of pipes and ducts by capping or plugging open ends.

F. Keep plug or cap in place until final connections are made.

1.05 JOB CONDITIONS

A. Examine Contract Documents to determine how other work will affect execution of mechanical work.

B. Determine and verify locations and arrangement of existing utilities, systems and equipment, and become familiar with existing conditions.

C. Make arrangements for and pay for necessary permits, licenses, and inspections.

PART 2 - PRODUCTS

2.01 EQUIPMENT AND MATERIALS

A. All materials shall be new and shall bear the manufacturer’s name, trade name and the UL label in every case where a standard has been established for the particular material. The equipment to be furnished under each section of the specification shall be essentially the standard product of a manufacturer regularly engaged in the production of the required type of equipment, and shall be the manufacturer’s latest approved design.

B. When two or more units of materials or equipment of the same type or class are required, these units shall be products of one manufacturer. Equipment and materials of the same general type shall be of the same make throughout the work to provide uniform appearance, operation and maintenance. Manufacturers of equipment assemblies, which use components made by others, assume complete responsibility for the final assembled product.
C. Nameplate bearing manufacturer's name or identifiable trademark shall be securely affixed in a conspicuous place on equipment, or name or trademark cast integrally with equipment, stamped or otherwise permanently marked on each item of equipment.

D. Asbestos products or equipment or materials containing asbestos shall not be used.

E. Equipment and materials shall be delivered to the site and stored in the original containers, suitably sheltered from the elements. Items subject to moisture damage (such as controls) shall be stored in dry, heated spaces.

F. Equipment shall be tightly covered and protected against dirt, water, and chemical or mechanical injury and theft. At the completion of the work, fixtures, equipment, and materials shall be cleaned and polished thoroughly. Damage or defects developing before acceptance of the work shall be made good at the Contractor's expense.

G. It shall be the responsibility of the Contractor to insure that items to be furnished fit the space available. The Contractor shall make necessary field measurements to ascertain space requirements, including those for connections, and shall furnish and install such sizes and shapes of equipment that the final installation shall suit the true intent and meaning of the Drawings and Specifications.

H. Manufacturer's directions shall be followed completely in the delivery, storage, protection, and installation of all equipment and materials. Should the Contractor perform any work that does not comply with the manufacturer's directions, he shall bear all costs arising in correcting the deficiencies.

2.02 EQUIPMENT ACCESSORIES

A. The Contractor shall furnish and install all equipment, accessories, connections, and incidental items necessary to fully complete the work, ready for use, occupancy and operation by the Owner, whether or not specifically shown on the plans or herein specified.

B. Connections: All piping connecting to equipment shall be installed without strain at the piping connection.

C. Connections Different From Those Shown: Where equipment requiring different arrangement or connections from those shown is approved, it shall be the responsibility of the Contractor to install the equipment to operate properly with the intent of the drawings and specifications. When directed, the Contractor shall submit drawings showing the proposed installation. If the proposed installation is approved, the Contractor shall make all incidental changes in piping, ductwork, supports, insulation, etc. The Contractor shall provide any additional valves, fittings, and other additional equipment required for the proper operation of the system resulting from the selection of equipment, including all required changes in affected trades. The Contractor shall be responsible for the proper location of roughing in and connections by other trades. All changes shall be made at no increase in the contract amount or additional cost to the other trades.
2.03 MATERIALS

A. Structural steel for supports: ASTM-A36/A36M.
   1. Type 304 stainless steel members installed in fan plenums or areas of high humidity or condensation, and outside.
   2. Furnish other members with hot dipped galvanized coating.
   3. Shop fabricate for field assembly using bolts.

B. Rain hoods and counter flashings not exposed to view:
   1. Stainless steel: Minimum 20 GA.
   2. Sheet copper: Minimum 24 OZ/SF.

C. Rain hoods and counterflashings exposed to view: As specified in Division 7 and/or as indicated on the Drawings.

D. Access doors, panels and frames:
   1. Style and type as required for material in which installed.
   2. Size: Minimum 12 x 12 inch, or as required to allow inspection and removal of items served.
   3. Minimum 14 GA sheet metal, cadmium plated or galvanized after fabrication and factory primed ready for painting.
   4. Key lock, keyed alike, for panels in public areas.
   5. Prime painted.
   6. Fire rated construction:
      a. Provide in fire rated walls, floors and ceiling.
      b. UL listed.
      c. Sandwich type door filled with insulation.
      d. 1-1/2 hr(B) fire rating.
      e. Automatic door closing system.
   7. Provide in walls, floors, and ceilings to permit access to equipment, devices and piping requiring service or adjustment.

PART 3 - EXECUTION

3.01 GENERAL

A. When significant changes in location of equipment, devices and fixtures are required, obtain approval of Engineer/Architect before making change.

B. Provide necessary offsets and crossovers in piping and ductwork, whether indicated or not.

C. Install piping and ductwork parallel to walls and vertically plumb.

D. Do not change indicated sizes without approval of Engineer/Architect.

E. Where mechanical items penetrate fire and/or smoke rated walls, ceilings, and floors, seal annular spaces with approved firestopping to maintain fire and smoke ratings.
F. Each Contractor shall provide all miscellaneous metal framing and supports necessary to secure pipe, duct, and equipment hangers to building structure.

3.02 EXCAVATING AND BACKFILLING

A. Perform excavating, trenching and backfilling:
   1. See Division 2.

3.03 INSTALLATION OF EQUIPMENT

A. Install equipment in accordance with manufacturer’s recommendations and as specified.

B. Provide necessary anchoring devices and supports.
   1. Use structural supports suitable for equipment, or as indicated.
   2. Check loadings and dimensions of equipment with shop drawings.
   3. Do not cut, or weld to, building structural members.
   4. Provide equipment supports even though not detailed on architectural and structural drawings.

C. Verify that equipment will fit support layouts indicated.
   1. Where substitute equipment is used, revise indicated or required supports to fit.

D. Arrange for necessary openings to allow entry of equipment.
   1. Where equipment cannot be installed as structure is being erected, provide and arrange for building in of boxes, sleeves or other devices to allow later installation.

E. Provide penetrations through roofs prior to installation of roofing.

F. Install rain hoods and metal counter flashings as indicated, and to make penetrations of mechanical work through walls and roofs water and weathertight.
   1. Furnish clamps, waterproofing material and labor.
   2. Where metal flashings are applied over concrete, paint concrete with 1/8 inch of mastic cement first.
   3. Set flashing in mastic cement, watertight.

G. Repair and replace roof construction which is damaged by this work in manner which will not nullify roof warranty.

H. Do not use equipment exceeding dimensions indicated on detail drawings or arrangements that reduce required clearances or exceed specified maximum dimensions.

I. Install equipment, piping and ductwork to permit easy access for normal maintenance.
   1. Maintain easy access to filters, motors, drives, compressors, and arrange piping, conduit, ducts and related work to facilitate maintenance.
   2. Relocate items which interfere with access.
J. Provide concrete foundations (isolation pads) or housekeeping pads required for mechanical equipment, as indicated or as follows:
   1. Install 3-1/2 inch high concrete housekeeping pads.
   2. Use 3,000 PSI concrete.
   3. Reinforce with No. 4 bars 12 inch OC each way, with short No. 4 dowels into floor at 24 inch OC each way, with 6 inch minimum penetration into floor.
   5. Make faces smooth.
   6. Set anchor bolts for equipment.
   7. Foundations or pads detailed on architectural or structural drawings are not furnished by Division 15.
   8. Isolation pads: See Section 15240.

K. Coordinate with General Work for installation of concrete foundations (isolation pads) or housekeeping pads required for mechanical equipment.

3.04 INSTALLATION OF EQUIPMENT FURNISHED BY OWNER OR OTHER DIVISIONS

A. Receive, uncrate and set in place mechanical equipment furnished by Owner or other Divisions.

B. Provide rough-in and final connections to equipment requiring mechanical services.
   1. For equipment furnished by Owner or other divisions: Obtain rough-in data from final shop drawings and coordinate with installation of utilities.

C. Install fittings, valves, and other items furnished as integral part of equipment, but shipped loose.

3.05 TEST AND INSPECTIONS

A. Test equipment and systems as indicated for each item, unless otherwise recommended by manufacturer.
   1. Tests specified in Section 15990, Testing and Balancing, need not be duplicated under other sections.

3.06 CLEANING

A. Clean exposed and concealed items: See Division 1.
   1. Clean air surfaces of coils, fans (including fan wheels and motors), air handler plenums and air filter frames.
   2. Clean floor drains, cleanouts, and plumbing fixtures.
   3. Clean specialties such as traps and strainers and equipment surfaces.
   4. Clean piping of tags, debris and other construction materials before insulating or painting.
   5. Clean dust, dirt, sand, and other debris out of ductwork.

B. Inspect equipment and systems, and put into satisfactory operation prior to final acceptance.
   1. At first heating or cooling season following final acceptance, start up systems not started due to lack of seasonal design load.
C. Operate systems in satisfactory working order for a minimum of 5 working days.

END OF SECTION
SECTION 15240
MECHANICAL SOUND AND VIBRATION CONTROL –
PLUMBING, HVAC AND FIRE PROTECTION

PART 1 - GENERAL

1.1. WORK INCLUDES
   A. Contractor provide vibration isolators and hangers.

1.2. QUALITY ASSURANCE
   A. Comply with ASHRAE, ASTM and AASHO standards.

1.3. SUBMITTALS (See Division 1)
   A. Shop drawings: Not required for Engineer/Architect review.
   B. Product Data:
   C. Samples: Not required for Engineer/Architect review.
   D. Project information: Not required for Engineer/Architect review.
   E. Contract closeout information: Not required for Engineer/Architect review.

PART 2 - PRODUCTS

2.1 GENERAL
   A. Acceptable Manufacturers:
      1. Sound and vibration control devices:
         a. Mason Industries.
         b. Vibration Mountings and Controls.
         c. Vibration Eliminator Co.
         d. Korfund Dynamics Corp.
         e. Amber-Booth Co.
         f. Peabody Noise Control, Inc.
      2. Other manufacturers desiring approval comply with Division 1.
   B. Provide piping and equipment isolation systems as specified and as indicated on drawings.
   C. Select vibration isolators in accordance with weight distribution to produce reasonably uniform deflection.
   D. Provide vibration isolation equipment including mountings, hangers, structural steel bases, welded concrete pouring forms and flexible pipe connectors from a single manufacturer of vibration isolation equipment.
E. Coat vibration isolation systems exposed to moisture and an outdoor environment as follows:
   1. Steel parts to be hot dipped galvanized.
   2. Bolts to be cadmium plated.
   3. Springs to be cadmium plated and neoprene coated.

2.2 VIBRATION ISOLATORS AND HANGERS

A. Equipment mounting isolators:
   1. Type 1 isolators: Neoprene pads or strips.
      a. Durometer or hardness to suit application.
      b. Standard pad thickness: \( \frac{1}{4} \) in.; provide optional pad thickness to suite application.
      c. Provide natural rubber, hycar, butyl, silicone or other elastomers as prior approved material.
      d. Provide type "W" adhesive, type "W", "WMW", "WML", or "WM"; or Vibration Mountings, type VM.

B. Vibration hangers:
   1. Type 2 isolators: Steel spring type hanger.
      a. Steel spring and 0.3 in. deflection neoprene element in series.
      b. Neoprene element to be molded with a rod isolation bushing that passes through hanger box.
      c. Springs to have a minimum additional travel to solid equal to 50 percent of rated deflection.
      d. Spring diameters and hanger box lower hole sizes shall be large enough to permit hanger rod to swing through a 30 degree arc before contacting hole and short circuiting spring.
      e. Mason Industries, Inc. type 30N; or Vibration Mountings, type RSH.

PART 3 - EXECUTION

3.1 VIBRATION CONTROL

A. Install vibration control equipment in accordance with manufacturers's installation instructions and as specified.

B. Vibration control equipment shall be selected as specified and sized in accordance with weight distribution, pull or torque imposed by shop drawing approved equipment being isolated.
   1. Minimum static deflections may be revised subject to prior approval.

C. Provide revised vibration control equipment to match revised or substituted equipment.

D. Provide structural and other equipment required to control expansion and contraction of piping, loops and offsets. Rigidly anchor pipe to building structure. Where necessary provide pipe guides so that movement takes place along axis of pipe only.

E. Provide all necessary auxiliary steel for proper operation and installation of isolation equipment.

F. Piping shall be free of any objectionable self-generated noise. Isolate piping from building where required to prevent transmission of noise.

G. Vibration Isolation:
1. No metal-to-metal contact will be permitted between fixed and floating parts.
2. Connections to Equipment: Allow for deflections equal to or greater than equipment deflections. Electrical, drain, piping connections, and other items made to rotating or reciprocating equipment (pumps, compressors, etc.) which rests on vibration isolators, shall be isolated from building structure for first three hangers or supports.
3. Common Foundation: Mount each electric motor on same foundation as driven machine. Hold driving motor and driven machine in positive rigid alignment with provision for adjusting motor alignment and belt tension. Bases shall be level throughout length and width. Provide shims to facilitate pipe connections, leveling, and bolting.
4. Provide heat shields where elastomers are subject to temperatures over 100 degrees F.
5. Extend bases for pipe elbow supports at discharge and suction connections at pumps. Pipe elbow supports shall not short circuit pump vibration to structure.

H. Inspection and Adjustments: Check for vibration and noise transmission through connections, piping, ductwork, foundations, and walls. Adjust, repair, or replace isolators as required to reduce vibration and noise transmissions to specified levels.

I. Where excessive noise is generated in a piping system, due to arrangement or velocity of the fluid within the pipe, the Contractor shall, at his expense, make modifications as required or as directed by the Engineer to reduce noise to an acceptable level.

3.2 VIBRATION ISOLATORS

A. Use type 1 isolators for the vertical upflow air handling units.

B. Use type 2 vibration hangers for the inline exhaust fans.

END OF SECTION
SECTION 15250
PIPE, DUCT AND EQUIPMENT INSULATION – PLUMBING, HVAC AND FIRE PROTECTION

PART 1 - GENERAL

1.1. WORK INCLUDES

A. Contractor provide:
1. Pipe insulation, non-flexible and flexible.
2. Duct insulation, non-flexible and flexible.
3. Insulation adhesives, mastics and caulking.

1.2. DEFINITIONS

A. Concealed insulated surfaces: Piping, ductwork and equipment in walls, partitions, floors, pipe chases, pipe shafts, duct shafts, sealed alleyways, and above suspended ceilings.

B. Exposed insulated surfaces: Piping, ductwork and equipment located in mechanical rooms, tunnels and rooms without suspended ceilings.

1.3. QUALITY ASSURANCE

A. Comply with fire and smoke hazard ratings indicated.
1. Test by procedure ASTM-E84, NFPA 255 and UL 723.
2. Accessories such as adhesives, mastics, cements, tapes, and glass fabric, same or better component ratings.
3. Following are rating requirements:
   a. Flame Spread (maximum): 25
   b. Smoke Developed (maximum): 50
4. Properly identify products and/or their shipping cartons for flame and smoke ratings.

B. Insulation thickness for piping and ductwork shall not be less than required by the State Energy Code.

1.4. SUBMITTALS (See Division 1)

A. Shop drawings: Not required for Engineer/Architect review.

B. Product data.

C. Samples: Not required for Engineer/Architect review.

D. Project information: Not required for Engineer/Architect review.

E. Contract closeout information: Not required for Engineer/Architect review.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

A. Fiberglass (Mineral Fiber) Pipe Insulation: Thermal conductivity shall be no greater than 0.23 btu in / hr sq. ft ° F. at 75° F mean temperature per ASTM C547 and rated for 0° to 850° F. Pipe
insulation shall be furnished with factory applied white all service (ASJ) vapor barrier jacket with self-sealing lap (ASJ-SSL). Fittings shall be pre-molded from same material.

B. Flexible Elastomeric Cellular Insulation: Thermal conductivity shall be no greater than 0.27 btu in / hr sq. ft °F. at 75° F mean temperature per ASTM C534, and rated for a maximum service temperature of 200° F. The flame spread rating shall be less than 25, and smoke developed rating shall be less than 50.

C. Fiberglass (Mineral Fiber) Duct Insulation Wrap: Thermal conductivity shall be no greater than 0.36 btu in / hr sq. ft °F. at 75° F mean temperature per ASTM C177 at twenty five percent compression. Insulation shall be rated for -20° to 450° F. Duct insulation shall be furnished with a two mil foil scrim kraft vapor barrier (FSK) and have a density of 0.75 pcf.

D. Low Temperature Vapor Retarder:
1. The contractor shall apply a low temperature vapor retarder over all longitudinal and lateral seams and joints on all piping systems transporting fluids sixty degrees F. or lower, including but not limited to; domestic cold water, chilled water supply and return, and condenser water supply and return.
2. Vapor retarder shall have a water vapor permeance of 0.07 perms at mean coverage rate. Flame spread shall be 15, and smoke developed shall be 15. The temperature service range for the vapor retarder shall be from -20 degrees F to 190 degrees F.

E. Mastic Coating:
1. The contractor shall apply a mastic coating over all longitudinal and lateral seams and joints on all piping systems transporting fluids or gases one hundred degrees F. or higher, including but not limited to; domestic hot water, domestic hot water return, heating water supply and return.
2. Mastic coating shall be required on insulation serving equipment having surfaces one hundred degrees and higher.
3. Mastic coating shall have a water vapor permeance of 1.0 perms at 0.063 inches film thickness. Flame spread shall be 10, and smoke developed shall be 40. Mastic coating shall have a service temperature range of -40 degrees F to 180 degrees F.

F. Jacketing:
1. Exterior Piping: Provide aluminum jacketing on all refrigerant suction piping outdoors. Aluminum jacketing shall be constructed of smooth .016 inch thickness ASTM B 209, Alloy 3003, H14 temper aluminum. All ell covers shall be two piece, factory fabricated type, made of 0.020 inch thick 3003 sheet aluminum. Bands shall be 3/8” wide, 0.015 inch thickness aluminum up to 8 inch diameter pipe.

G. Mechanical Fasteners:
1. Weld-Attached Anchor Pins and Washers: Copper-coated steel pin for capacitor-discharge welding and galvanized speed washer. Pin length sufficient for insulation thickness indicated. Welded pin holding capacity shall be a minimum 100 lb for direct pull perpendicular to the attached surface.
2. Self-Adhesive Anchor Pins and Speed Washers: Galvanized steel plate, pin, and washer manufactured for attachment to duct and plenum with adhesive. Pin length sufficient for insulation thickness indicated.
3. Staples: Outward clinching monel or stainless steel.
4. Wire: 18 gage soft annealed galvanized, or 14 gage copper clad steel or nickel copper alloy.
5. Bands: 3/4 inch nominal width, galvanized steel indoors and aluminum or stainless steel outdoors and wet locations,

H. Tapes:
1. Metallic Sealing Tape: Aluminum tape shall be 3 inch width (minimum) with 15 mils of elastomeric modified butyl adhesive on 2 mil foil backing. Tape shall comply with UL 181B-FX.
2. Tape for Flexible Unicellular Insulation: Scotch No. 472, Nashua PE-12, or product recommended by the insulation manufacturer.
3. Glass Fiber Fitting Tape: Mil. Spec. MIL-C-20079, Type II, Class 1

2.2 INSULATION MATERIALS

A. Acceptable manufacturers:
   1. Insulation materials:
      a. Certainteed (CSG).
      b. Owens-Corning (O-C).
      c. Manville.
      d. Armstrong.
      e. Knauf.
      f. PPG Industries.
   2. Insulated fitting covers:
      a. Manville.
      b. Certainteed.
      c. Knauf.
   3. Adhesives, mastics and coatings:
      a. Foster (B.F.).
      b. Childers.
      c. Chicago (CMC).
      d. Armstrong.
   4. Other manufacturers desiring approval comply with Division 1.

B. General:
   1. Provide fire and smoke hazard ratings as indicated for entire composite (insulation, jacket or facing, and adhesive used to adhere facing or jacket to insulation).
   2. Do not use material that exceeds specified flame and smoke ratings.
   3. Use permanent treatments to jackets or facings to impart specified fire ratings.
   4. Use of water soluble treatments is prohibited.
   5. At hangers and bracing: See Section 15140.

2.3 PIPE INSULATION, NON-FLEXIBLE

A. Pipe insulation, non-flexible: O-C Fiberglas ASJ/SSL-II with all service jacket (ASJ).
   1. Thermal conductivity (K value): Not greater than 0.23 at mean temperature of 75 deg F.
   2. Apply to following piping in thickness indicated:
      a. Domestic cold water piping:
         1) ½ to 2 IN 1/2 IN.
      b. Domestic hot water (100-140 deg F):
         1) ½ to 2 IN 1 IN.
      c. Cooling coil condensate drains:
         1) All sizes 1 IN.
      d. Hot water and waste lines below handicap lavatories: 1/2 IN.
      e. Refrigerant piping (Below 40 deg F):
         1) Runouts to 1 ½ IN 1 IN.
         2) 1 IN and smaller 1 IN.
         3) 1¼ IN and larger 2 IN.

2.4 PIPE INSULATION, FLEXIBLE
   1. Thermal conductivity (K value): Not greater than 0.27 at mean temperature of 75°F.
   2. Apply to following piping in thickness indicated:
      a. Domestic cold water piping:
         1) 2 IN and smaller ½ IN.
      b. Domestic hot water piping (100-140 deg F):
         1) 2 IN and smaller 1 IN.
      c. Cooling coil condensate:
         1) 2 IN and smaller ½ IN.
      d. Refrigerant suction piping (below 40 deg F.):
         1) 1 IN and smaller 1 IN.

2.5 DUCTWORK INSULATION, FLEXIBLE

A. Ductwork insulation, flexible: O-C Fiberglas Commercial Grade Faced Duct Wrap insulation with FRK vapor barrier jacket and 2 IN tab.
   1. Thermal conductivity (K value): Not greater than 0.28 at mean temperature of 75°F.
   2. Apply to following ductwork in thickness indicated:
      a. Outside air ductwork: 2 IN.
      b. Supply air ductwork: 2 IN.
      c. Return air ductwork: 2 IN.
      d. Exhaust air ductwork: 2 IN.
   3. The top of all supply grilles shall be insulated with 2 IN. thickness flexible ductwork insulation.
   4. Do not apply insulation over coil and damper access panels or over internally lined ductwork.

2.6 SOUND ABSORBING LINER FOR DUCTWORK

A. All ductwork which communicates to the outdoors, serving outside air louvers, exhaust louvers, etc. shall be lined with 1” thickness closed cell elastomeric insulation, Armstrong Armaflex II foam plastic sheet insulation; material installed in 2 layers with joints staggered.

B. Thermal conductivity (K value): Not greater than 0.27 at mean temperature of 75°F.

2.7 INSULATION FASTENERS

A. Insulation adhesive: Childers CP-82.


C. Insulation caulking: Dow No.11.

PART 3 - EXECUTION

3.1 APPLICATION - GENERAL

A. Do not insulate piping until satisfactory completion of required pressure tests.

B. Apply insulation materials, accessories, and finishes according to the manufacturer’s written instructions, with smooth, straight and even surfaces and free of voids throughout the length of ducts and fittings. Apply insulation with the least number of joints practical.
C. Do not insulate piping below ground (covered with earth) except domestic water and heating water runouts to fixtures and terminal heating equipment within 5 FT of outside walls.

D. Apply insulation to clean, dry surfaces with pipe and duct surfaces at room temperature. Keep insulation materials dry during application and finishing. Use accessories compatible with insulation materials and suitable for the service.

E. Use accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

F. Butt insulation firmly together with longitudinal and end joints sealed with compatible jackets, facings and adhesives as specified. Apply multiple layers of insulation with longitudinal and end seams staggered. Apply insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by the insulation material manufacturer.

G. Where vapor retarder is indicated, seal penetrations in insulation at hangers, supports, anchors, and other projections with vapor-retarder mastic. Apply insulation continuously through hangers and around anchor attachments.

H. Apply adhesives, mastics and coatings per manufacturer's recommendations and as specified.

I. Apply insulation with integral jackets as follows:
   1. Pull jacket tight and smooth.
   2. Joints and Seams: Cover with tape and vapor retarder as recommended by insulation material manufacturer to maintain vapor seal.
   3. Vapor-Retarder Mastics: Where vapor retarders are indicated, apply mastic on seams and joints and at ends adjacent to duct flanges and fittings.

J. On cold surfaces where vapor barrier jackets are used, apply insulation with a continuous, unbroken vapor seal.
   1. Adequately insulate and vapor seal hangers, supports, and anchors that are secured directly to cold surfaces to prevent condensation.
   2. For insulation application where vapor retarders are indicated, seal ends with a compound recommended by the insulation material manufacturer to maintain vapor retarder.

K. Continue insulation through sleeves and wall and ceiling openings except insulation shall not continue through fire rated (2 hour or greater) partitions, walls, floor-ceiling systems.

L. Insulate fittings, valve bodies, flanges and other pipeline devices and accessories. Devices and accessories which require servicing and/or inspection, shall have means of removal and reinstallation of the insulation without damaging the insulation or requiring replacement.

M. At hangers and bracing install in accord with Section 15140.

3.2 APPLICATION OF NON-FLEXIBLE PIPE INSULATION

A. On piping, install with lap joint attached using outward clinching staples, 3 IN centers, 1/4 IN from edge on hot piping.
   1. On cold piping use self-sealing lap system or adhesive applied to both surfaces per manufacturer's recommendation.
   2. Do not staple cold piping.
   3. Butt adjoining sections of insulation tightly together and continue jacket by installing self-adhering butt strips over entire circumferential joint.

B. Installation of insulation of fittings:
1. For pipe sizes 2 IN and smaller finish with mineral fiber cement to thickness of adjoining pipe insulation.
2. Over 2 IN insulate with mitered pipe insulation segments or preformed fiberglass fittings secured with vinyl faced insulation strapping tape or 20 GA galvanized annealed wire and finished with one coat of mineral fiber cement.
3. After cement is dry finish with Glass Fab and seal with Foster 30-36 adhesive.
4. Prefabricated fitting covers approved for use at pipe fittings may be used instead of finishing method outlined above.
5. Install in accord with manufacturer’s recommendations.

C. Cover insulated piping exposed to weather with additional jacket of 0.016 IN smooth aluminum with moisture barrier.
   1. Apply aluminum jacket with 0.020 IN x 3/8 aluminum bands on 9 IN centers, minimum 2 IN lap joint.
   2. Protect fittings exposed to weather in like manner.
   3. Contractor option: Use Ceel-Co 300 series plastic jacketing applied per manufacturer’s recommendations.

3.3 APPLICATION OF FLEXIBLE PIPE INSULATION
A. Install the proper size insulation, do not stretch or strain insulation. Where possible, slip insulation over the pipe or tubing prior to connection, and brush a light coat of manufacturer’s recommended adhesive to all seams and butt joints. Otherwise slit pipe insulation, tightly butt ends and seal butt joints and slit seams with suitable adhesive. Insure all seams are fully covered with adhesive and the surface nearest the pipe pressed together first and evenly before joining the entire surface.

B. On all runouts with elastomeric pipe insulation, brush a light coat of manufacturer’s recommended adhesive to both surfaces and allow the adhesive to set until dry to the touch. All seams and butt joints must be fully covered with adhesive and the surface nearest the pipe should be pressed together first and evenly before joining the entire surface.

C. Insulate fittings and valve bodies with segments cut from pipe insulation. Apply with adhesive.

D. Insulate piping at hanger points with fiberglass material protected with metal saddles.

E. Cover insulated piping exposed to weather with additional jacket of 0.016 IN smooth aluminum with vapor barrier.

3.4 APPLICATION OF FLEXIBLE DUCTWORK INSULATION
A. Cold ductwork: Apply insulation with edges tightly butted and secured to metal surface with 4 IN wide strips of adhesive on 12 IN centers.
   1. At joints lap facing tab over adjoining facing 2 IN and seal with lap adhesive or use 3 IN wide pressure sensitive joint sealing tape to match jacket.
   2. Secure lap with staples on 6 IN centers.
   3. Seal staples with mastic (Foster 35-00-GPM).
   4. On ductwork over 24 IN wide (rectangular and flat oval) impale insulation to bottom of duct over mechanical fasteners such as welded pins and secure with speed clips.
   5. Space pins to hold insulation securely in place but not over 18 IN centers.
   6. Seal clips with 3 IN wide tape patches, staple corners and seal with mastic.

B. Any damage to the insulation facing shall be repaired by:
   1. Replacing section of insulation.
2. Taping over damaged area using 3” wide aluminum tape with 15 mils of modified butyl adhesive on 2 mil foil backing. Tape shall comply with UL 181 B-FX. Taping over damaged areas will require the approval of the Engineer/Architect.

3.5 APPLICATION OF SOUND ABSORBING LINER FOR DUCTWORK

A. Apply with Armstrong 520 adhesive covering entire surface as well as back of insulation.

B. Coat butt edges and press firmly together with 1/8 IN overlay pressure.

C. Apply 2 coats of Armstrong Armaflex finish over sheet surfaces.

END OF SECTION
SECTION 15260

PIPING SUPPORTS, SLEEVES AND SEALS – PLUMBING, HVAC AND FIRE PROTECTION

PART 1 - GENERAL

1.01. WORK INCLUDES

A. Contractor provide:
   1. Pipe and equipment hangers and supports.
   2. Equipment bases and supports.
   3. Sleeves and seals.
   4. Flashing and sealing equipment and pipe stacks.

B. Each contractor shall be responsible for providing miscellaneous metals to span structural members to support equipment, piping, ductwork and/or conduit.

1.02. REFERENCES

A. ASME B31.5 - Refrigeration Piping
B. ASME B31.9 - Building Services Piping
C. ASTM F708 - Design and Installation of Rigid Pipe Hangers.
D. MSS SP58 - Pipe Hangers and Supports - Materials, Design and Manufacturer.
E. MSS SP69 - Pipe Hangers and Supports - Selection and Application.
F. MSS SP89 - Pipe Hangers and Supports - Fabrication and Installation Practices.
G. NFPA 13 - Installation of Sprinkler Systems.
H. UL 203 - Pipe Hanger Equipment for Fire Protection Service

1.03. SUBMITTALS (See Division 1)

A. Product Data: Provide manufacturers catalog data including load capacity.

B. Manufacturer's Installation Instructions: Indicate special procedures and assembly of components.

1.04. REGULATORY REQUIREMENTS

A. Conform to applicable code for support of plumbing and condensate drain piping.

B. Supports for Sprinkler Piping: In conformance with NFPA 13.
PART 2 - PRODUCTS

2.01. GENERAL

A. Acceptable Manufacturers:
   1. Sleeves:
      a. Shop or field fabricated.
      b. Shamrock Industries, "Crete-sleeve" plastic hole forms.
   2. Pipe hangers:
      a. B-Line Systems, Inc.
      b. Grinnell Corp.
      c. PHD Manufacturing, Inc.
   3. Concrete anchors:
      b. Hilti.
      c. Rawl.
   4. Sealants:
      a. Dow Corning.
      b. Nelson.
      c. 3M Co.
      d. General Electric.
      e. Pipe Shields, Inc.
      f. Proset Systems, Inc.
   5. Other manufacturers desiring approval comply with the Contract Documents.

2.02. SLEEVES

A. Sleeves - general:
   1. Sleeve piping passing through walls, floors, roofs, foundations, footings and grade beams sufficient to allow free movement of piping with insulation continuous through sleeve.
   2. Box out openings larger than 14 in. diameter.

B. Sleeves, steel pipe: Use in following locations:
   1. Concrete floors and walls and concrete block walls.
   2. Structural concrete members.
   3. Optional products for concrete floors:
      a. Polyethylene hole forms (Crete-Sleeve).
      b. "Proset".
      c. 18 ga. galvanized steel metal.
      d. 24 ga. spiral duct.

C. Sleeves for plastic piping:
   1. Provide steel pipe sleeves for plastic type piping (PVC, CPVC and polypropylene) at fire rated assembly and floor slab penetrations.
   2. Size sleeves per following schedule:
<table>
<thead>
<tr>
<th>Pipe Size (IN)</th>
<th>Sleeve Size (IN)</th>
<th>Extension beyond barrier (FT)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 or less</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>1 to 2</td>
<td>4</td>
<td>2</td>
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<td>3</td>
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<tr>
<td>4</td>
<td>6</td>
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</tr>
</tbody>
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3. Extend sleeve listed distance beyond wall or floor on both sides.
4. Insulate plastic pipe with minimum 1 in. thick calcium silicate or 2400 deg. F aluminasilica within sleeve length.

D. Sleeves, pre-manufactured fire and smoke wall barrier: Optional, similar to Pipe Shields, Inc.
1. Bare pipe through fire walls and floors: Model WFB, DFB, or QDFB.
2. Insulated pipe through fire walls and floors: Model WFB, DFB, or QDFB.
   a. Insulated chilled water and DX lines: Type CS-CW.
   b. Other insulated pipes: Type CS.
3. Plastic pipe through fire walls and floors: Type WFB with 1 inch thick calcium silicate insulation encased in metal sleeve extension 2 feet either side of fire rated walls or floor.

E. Sleeve sizes:
1. Diameter:
   a. Minimum 3 inch
   b. Minimum 1 inch larger than pipe and pipe insulation.
   c. In concrete, 1/2 inch larger than pipe.
   d. Diameter suitable for construction tolerances and to receive sealant.

F. Pipe entrance wall sleeve and anchoring:
1. Provide steel, heavy wall welded or seamless pipe sleeve full circle continuously welded water stop plate.
2. Provide sleeve full length of wall thickness and protect with a primer coat.
3. Structurally secure pipe to withstand water hammer force.
   a. Extend exterior piping into building a minimum of 12 inch.
   b. Provide a mechanical joint on interior end of pipe and mechanically tie end back to adjoining structural (exterior) wall.
4. Provide "link seal" on pipe at exterior side of sleeve.

G. Sealants: Seal annular space around piping.
1. For fire and smoke rated floors, walls and partitions: Use UL listed firestopping material that maintains fire rated wall and floor integrity.
   a. Provide proper material for each typical application as described by manufacturer.
2. Acceptable Products:
   a. Dow Corning "Fire Stop".
   b. Nelson "Flameseal".
   c. 3M "Fire Barrier".
   d. GE Pensil 200 Firestop Foam.
   e. GE Pensil 100 Firestop Sealant.
   f. Pipe Shields Inc. Model WFB, DFB or QDFB series.
g. Proset Systems.
3. For non-rated walls and partitions: Use mineral or glass fiber insulation.
4. For exterior and foundation walls: Use synthetic rubber seals, "Link-Seal" waterproof material or system.

2.03. PIPE HANGERS

A. Pipe hangers - General:
1. Materials, design and manufacture: MSS SP-58 with hot dipped galvanized finish.
2. Fabrication and installation: MSS SP-89.
4. Hangers supporting copper pipe: Copper or cadmium plated.
   a. Felt isolator pads may be used on carbon steel hangers.
5. Other hangers and channels, angles, and supporting steel: Cadmium plated or galvanized.
6. Pipes running parallel may be supported on trapeze hangers.
7. Hanger rods of continuous thread type: Electro-galvanize or cadmium plate after threads are cut.
8. Where grooved pipe couplings are used, place hanger within 2 ft. each side of fittings or refer to manufacturer's pipe support and anchorage guide.

B. Structural considerations:
1. Steel or concrete roof/floor system including slabs or roof deck shall be in place and complete before installation of mechanical piping system.
2. Space hangers so maximum individual hanger load will not exceed values listed in paragraph "Pipe Hanger Loading".
3. Do not attach hangers to steel roof deck.
4. Do not attach hangers to bottom of concrete filled floor deck except by permission of Architect.
5. Attach hangers to structural framing.

C. Pipe hanger spacing:
1. Locate hangers at each change of direction and space at or within following maximum limits:

<table>
<thead>
<tr>
<th>Pipe Diameter</th>
<th>Standard Steel Fluid</th>
<th>Standard Steel Vapor</th>
<th>Copper Fluid</th>
<th>Copper Vapor</th>
<th>Schedule 40 PVC Fluid</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/2 - 1 in.</td>
<td>7 ft.</td>
<td>8 ft.</td>
<td>5 ft.</td>
<td>6 ft.</td>
<td>4 ft.</td>
</tr>
<tr>
<td>1.25 - 2 in.</td>
<td>7 ft.</td>
<td>9 ft.</td>
<td>7 ft.</td>
<td>9 ft.</td>
<td>4 ft.</td>
</tr>
<tr>
<td>2.5 - 3 in.</td>
<td>11 ft.</td>
<td>14 ft.</td>
<td>9 ft.</td>
<td>13 ft.</td>
<td>5 ft.</td>
</tr>
<tr>
<td>3.5 - 4 in.</td>
<td>13 ft.</td>
<td>16 ft.</td>
<td>11 ft.</td>
<td>15 ft.</td>
<td>6 ft.</td>
</tr>
</tbody>
</table>
2. For fire protection piping, space according to NFPA Section 13.
3. For piping of other materials, space hangers according to manufacturer's recommendations.

D. Pipe hanger rod loading:
1. Total hanger rod load (including piping, insulation, and fluid) not exceeding following limits:
Nominal Rod Diameter | Maximum Load
---|---
3/8 in. | 610 lb.
1/2 in. | 1130 lb.
5/8 in. | 1810 lb.
3/4 in. | 2710 lb.

2. Do not exceed manufacturer’s recommended maximum safe load if smaller than above.

E. Pipe hangers for insulated and bare pipe:
   1. Insulated pipe:
      | NSS B-LINE | GRINNELL | PHD |
      | 1 | 3108 | 300 | 430 |
      | 3 | 3144 | 295 | 525 |

2. Bare pipe:
   | MSS | B-LINE | GRINNELL | PHD |
   | 1 | B3100 / 02 C | 260 | 450 |
   | 3 | 3144 | 295 | 525 |
   | 4 | 3142 | 216 | 522 |
   | 7 | 3172 | c | 180 |
   | 9 | c | 97 / 97C | -- |
   | 10 | 3170 | 70 | 151 |
   | 11 | 3173 | 108 | 500 |
   | 12 | 3104 | 65 | 440 |
   | 24 | 3188 | 137 | 90 |

3. Use pipe hanger MSS Type 10 only on pipe sizes 6 in. or less.

F. Pipe hangers in other situations: See MSS-SP-69.

G. Pipe hangers on insulated lines:
   1. Pipe sizes 2 in. and less: Use pipe covering shield to protect insulation.
      a. Minimum shield length: 12 in.
      b. Minimum shield thickness: 18 ga.

H. Trapeze hangers:
   1. Suspend trapeze hangers from concrete inserts, approved structural clips or beam clamps.
   2. Construct trapeze hangers of stainless steel or galvanized angle iron as specified, strut channels or other structural shapes with flat surfaces for point of support.
   3. Use pipe clamps or straps to support pipes on trapeze hangers.
      a. When supporting bare copper piping, isolate copper pipe from galvanized trapeze hanger with rubber or elastomeric material.
   4. Hanger rods shall not be any longer than ½ inch below the lower nut.

I. Vertical pipe supports and guides:
   1. Support vertical pipe runs in pipe chases at base of riser and on every other floor.
2. Support pipes for lateral movement with clamps or brackets on alternating floors of pipe supports.

J. C-clamps shall be hot dipped galvanized:
   1. Pipe size 3 in. and less:
      a. B-Line Figure B351L or B3033.
      b. Grinnell Figure 86 or 61.
      c. PHD Figure 250 or 360.

K. Beam clamps shall be hot dipped galvanized:
   1. Pipe size larger than 3 inch:
      a. B-Line Figure B3054 or B3055.
      b. Grinnell Figure 219, 228, 229 or 292.
      c. PHD Figure 630 or 625.

2.04. PIPE AND EQUIPMENT ANCHORS

A. Anchors for ductwork, equipment and piping hanger rods:
   1. Anchoring devices shall be installed in existing concrete using hard metal type which do not depend on soft lead for their holding power.

PART 3 - EXECUTION

3.01. GENERAL

A. Install components as indicated and in accordance with manufacturer's instructions and recommendations.

3.02. SLEEVES

A. Coordinate location of opening in structural systems with Architect.

B. Maintain rating of fire and smoke rated construction.

C. Set sleeves plumb or level, in proper position, tightly fitted into work.

D. Set sleeves with ends flush with finished wall and ceiling surfaces, except for plastic piping sleeves.

E. Set floor penetration sleeves with top 4 in. above finished floor:
   1. Mechanical rooms.
   2. Laundry rooms.

F. Seal around pipes and use firestopping for mechanical penetrations through floor slabs, fire rated walls and partitions, and at each floor level in vertical mechanical service shafts.
   1. Install firestopping as described in manufacturers installation instructions.

G. Seal around sleeves.

END OF SECTION
PART 1 - GENERAL

1.1. WORK INCLUDES

A. Contractor provide for fire protection systems:
   1. Wet-pipe sprinkler system.
   2. Pipe, fittings, and hangers.
   4. Fire system valves.
   5. Alarm and signal devices.
   7. Pressure gauges.

1.2. QUALITY ASSURANCE

A. Design criteria:
   1. Provide complete fire protection systems as indicated and as required by local authorities.
   2. Where there is conflict between local authority requirements or other standards agency requirements and these Drawings and specifications, requirements of standards agencies of local authorities shall govern.
   3. Design and install entire system in accordance with indicated codes, standards and regulations.
   4. Contractor shall hydraulically calculate sprinkler system in accordance with NFPA 13, based on hazard encountered.
   5. Drawings are diagrammatic only to indicate rooms/areas of sprinkler protection and piping clearances when appropriate.
   6. Rerouting of pipe and addition, deletion or relocation of heads may be necessary.
   7. Submit proposed layout and flow calculations for local fire authority's approval prior to shop drawing submittal.
   8. Coordinate head locations with ceiling layouts.

B. Hazard class:
   1. Major portion of building is classified Ordinary Hazard for sprinkler protection.
   2. Indicate classification of sprinkled spaces on shop drawings.

C. System standards:
   1. NFPA 13, Sprinkler Systems
   3. Owner's insurance requirements.
   4. State Inspection Agency (Building Code Dept.).
   5. Local Inspection Agency (Building Code Dept.).
   6. State Fire Marshal's requirements.
   7. Local Fire Marshal's requirements.

D. Installer qualifications:
1. Use workmen skilled in this trade.

1.3. SUBMITTALS (See Division 1)

A. Shop drawings:
   1. Complete layout of fire protection system approved by agencies having jurisdiction.
      a. Include flow calculations.

B. Product data: Piping, fittings, hangers, alarm devices and heads.

C. Samples: Not required for Engineer/Architect review.

D. Project information: Not required for Engineer/Architect review.

E. Contract closeout information:
   1. Operating and maintenance data.
   2. Owner instruction report.
   3. Test reports:
      a. Certification that tests as indicated in this section's Part 3 paragraph "Field Quality Control" have been successfully completed and approved by authorities having jurisdiction.
   4. Extra materials.

1.4. JOB CONDITIONS

A. Arrange and pay for permits, fees and inspections required.

PART 2 - PRODUCTS

2.1 MATERIALS - GENERAL

A. Acceptable manufacturers:
   1. Fire system valves:
      a. Reliable.
      b. Viking Corp.
      c. Automatic Sprinkler Corp.
      d. Central Sprinkler Corp.
      e. Firematic Sprinkler Devices, Inc.
      f. Grinnell Corp.
      g. Globe Fire Equipment Co.
      h. Star Sprinkler Corp.
      i. Potter-Roemer, Inc.
   2. Alarm-test device:
      a. Viking.
      b. Grinnell Corp.
      c. Victaulic.
   3. Alarm and signal devices:
      a. Viking.
      b. Notifier.
      c. Federal Signal Corp.
      d. Grinnell Corp.
      e. Potter Electric Signal Co.
4. Sprinkler heads:
   a. Reliable.
   b. Viking.
   c. Automatic Sprinkler Corp.
   d. Central Sprinkler Corp.
   e. Grinnell Corp.
   f. Firematic Sprinkler Devices, Inc.
   g. Globe Fire Equipment Co.
   h. Star Sprinkler Corp.
   i. Viking Corp.

5. Mechanical fittings and couplings:
   a. Victaulic Company of America.
   b. Grinnell.
   c. Tyler Pipe/Gustin-Bacon Division.

6. Other manufacturers desiring approval comply with Division 1.

B. Submit other pipe materials, joining methods and equipment not specified, but approved by NFPA 13 and local authority having jurisdiction, for approval in accordance with Section 01630.

C. Use only new material of first class construction, designed and guaranteed to perform service required and NFPA approved.

2.2 WET-PIPE SPRINKLER SYSTEM

A. Wet-pipe sprinkler system: Automatic sprinkler system employing closed sprinklers attach to a piping system full of water.
   1. Actuation of individual sprinkler head permits water to flow through the piping system into the space.
   2. In a combination standpipe/sprinkler system, do not interconnect standpipes through sprinkler piping.

2.3 PIPE, FITTINGS, AND HANGERS

A. Piping:
      c. Mechanical grooved couplings:
         1) NFPA 13 approved combination of couplings, gaskets and grooves.
         2) Rolled or cut grooves dimensionally compatible with couplings.

B. Fittings:
   1. Screwed
      b. Black malleable iron, 150 LB Class: ANSI-B16.3.

      a. Black cast iron, short body, Class 125.
      b. Gaskets: Full face of 1/8 IN minimum red sheet rubber.
      c. Flange bolts: ANSI-B18.2.
1) Hexagon head machine bolts with heavy semi-finished hexagon head nuts, cadmium plated.

   a. Black steel, standard weights.

   a. Malleable iron, 500 PSI working pressure.
   b. Coupling gasket material: Butyl rubber.
   c. Tested and listed by UL, FM or NFPA 13.

C. Fire sprinkler piping above ground:
   1. 2 IN and smaller:
      a. Black steel, Schedule 40 with threaded joints and malleable or cast iron fittings.
      b. Black steel, Schedule 40 with cut grooved joints and malleable-iron, flexible couplings and steel fittings.
   2. 2-1/2 IN to 5 IN:
      a. Black steel, Schedule 40 with welded, flanged, or roll grooved joints with flexible couplings and steel fittings.
      b. Black steel, Schedule 40 with cut grooved joints, malleable-iron, flexible couplings, and steel fittings.

D. Fire protection piping below ground: Ductile cast iron, lined and coated, with mechanical joint fittings.

E. Pipe hangers:
   1. All-purpose type, UL listed and FM approved.
   2. Comply with Section 15140.
   3. Hangers, hanger rods, inserts and clamps constructed as approved by NFPA.

2.4 MANUAL VALVES

A. Gate valves:
   1. 2 IN and smaller: 175 LB UL-FM bronze gate, solid wedge disc, OS & Y, screwed.
   2. 2-1/2 IN and larger: 175 LB UL-FM iron body gate, solid wedge disc, OS & Y, flanged.

B. Butterfly valves:
   1. 2 IN and smaller: 175 LB UL-FM bronze body butterfly, stainless steel stem and disc, Viton seal, anti-blowout stem, screwed.
   2. 2-1/2 IN and larger: 175 LB UL-FM iron body butterfly, 0-Ring seat, alum-bronze disc, stainless steel stem, Buna-N seal, flanged.

C. Butterfly valves with tamper switches:
   1. 2-1/2 IN and smaller: 175 LB UL-FM bronze body butterfly, stainless steel disc and stem, manual operator of scotch yoke design and visual position indicator, one SPDT prewired micro switch, threaded.
   2. 3 IN and larger: 175 LB UL-FM butterfly, ductile iron body with PPS coating, ductile iron disk with EPDM coating, manual geared operator with visual position indicator, one SPDT or DPDT prewired micro switch, and grooved ends.

D. Check valves 2-1/2 IN and larger: 175 LB UL-FM iron body check, horizontal swing, renewable seat and disc, flanged or 250 LB UL-FM iron body check, rubber or EPDM seat, spring actuated, wafer style, or grooved end body.

2.5 FIRE SYSTEM VALVES
A. General:
   1. UL listed and FM approved.
   2. 2 IN and smaller: Threaded.
   3. 2-1/2 IN and larger: Flanged or grooved.

2.6 ALARM TEST DEVICE:

A. Alarm test device:
   1. Optional replacement for alarm test loop.
   2. Single device or unit that provides visual verification of water flow (as required by NFPA 13) in a fire sprinkler system and allows for draining of all or a portion of that system.
   3. Contains sight glass, inspector test valve, auxiliary drain valve and test orifice.
   4. UL listed and FM approved.

2.7 ALARM AND SIGNAL DEVICES

A. General:
   1. UL listed and FM approved.
   2. Provide contacts for connection to fire alarm system.
   3. Coordinate electrical requirements with Owner.

B. Water flow detector:
   1. Vane type flow switch with retard mechanism or manual adjustment to prevent false alarm.
   2. 175 PSI rated.
   3. Suitable for working pressure of 150 PSI with sensitivity adjusting screw.
   4. Designed to signal fire alarm system when water flows.

C. Valve tamper switch: Designed to signal fire alarm system upon valve movement.

2.8 FIRE ALARM SYSTEM CONTROL PANEL

A. Provided in Division 16.
2.9 SPRINKLER HEADS

A. Sprinkler heads - general:
   1. Provide heads of type required for service indicated.
   2. Standard 165 deg. F rating except when application requires higher rating.
   3. In no case use heads rated less than 50 deg. F higher than anticipated ambient temperature.
   4. Sprinklers UL listed.
   5. Metallic fusible link or glass bulb type.
   6. Head application:
      a. Rooms without ceilings: Type 1.
      b. Finished rooms: Type 2.
      c. Side Walls: Type 3.
   7. Provide sprinklers with 1/2 IN orifice unless specifically noted otherwise.

B. Sprinkler head Type 1:
   1. Upright or pendent design as required.
   2. Standard bronze finish.

C. Sprinkler head Type 2:
   1. Recessed design, deflector 1 to 1-1/2 IN below finished ceiling.
   2. 2 piece recessed escutcheon with 1/2 IN adjustment.
   3. Allow removal of escutcheon and ceiling tile without disturbing head and drop assembly.
   4. Chrome finish.

D. Sprinkler head Type 3:
   1. Horizontal sidewall design.
   2. 2 piece recessed escutcheon.
   3. Satin chrome finish.

2.10 PRESSURE GAUGES

A. Pressure gauges: See Section 15120.
   1. UL listed and FM approved.
   2. Provide shutoff valve and drain.

2.11 EXTRA MATERIALS

A. Tools:
   1. Furnish one emergency rubber ball shutoff on long handle to be used for temporary closing of sprinkler head after fire has been extinguished.
   2. Furnish testing apparatus capable of producing the heat or impulse necessary to operate supplemental fire detection systems.

B. Sprinkler cabinet: Wall mounted.
   1. Provide spare heads of each type and sprinkler wrench for each type in quantity required by NFPA 13.
   2. Provide spare fire-detection elements for supplemental fire detection systems.
PART 3 - EXECUTION

3.1 GENERAL

A. Cooperate with other trades to ensure adequate space for equipment and piping placement.

B. Review plans, specifications and shop drawings of other trades to coordinate work.

C. Install in strict accordance with approved shop drawings.

D. Do not begin installation until Agency approvals are submitted to Engineer/Architect.

3.2 INSTALLATION OF PIPING, VALVES, AND ACCESSORIES

A. Install systems in accordance with approved shop drawings.
   1. Modifications to system design or arrangement after approval of Drawings by local authority, may only be made after receiving written approval of authority and Engineer/Architect.
   2. Such modifications do not include minor relocations in piping or head placement.
   3. Make revisions in accordance with NFPA 13.

B. Install sprinkler piping in coordination with other trades.
   1. Offset crossover and otherwise route piping to install system in available space.
   2. Not every offset is shown.
   3. Pitch branch lines, cross mains, feed mains and risers to drainage points.
   4. Plugs are permitted at offsets when approved by local authority.

C. Install dirt legs and drain valves at low points of systems to permit complete drainage of systems without disconnection of piping.

D. Install pipe hangers and supports in accordance with NFPA 13.

E. Install valve and water flow detectors within sprinkler system at each of following locations:
   1. Within single-zone sprinkler systems, at base of sprinkler riser.

F. Install alarm test loop after each water flow detector.
   1. Test loop: Two-branch, parallel piping assembly.
      a. Inspector's test branch shall contain a shutoff valve and a restricting orifice imitating the flow through the smallest sprinkler head on the system. Provide means for inspector to observe water flow (e.g., drain water within sight of valve or provide sight glass).
      b. Drain branch shall contain shutoff valve.
      c. Provide pressure gauge at or near loop.
      d. Size branches based on riser or main size.
         1) Riser or Main is 2 IN or smaller: ¾ to 2 IN.
         2) Riser or main is 2½ to 3½ IN: 1¼ to 2 IN.
   2. Extend loops to nearest floor drain or janitor's sink.
   3. Terminate loops outside when approved by local authority.
   4. Label valves and outlets.

G. Install valve tamper switch on each OS&Y or butterfly valve within system.

H. Flush outside fire water mains prior to connecting to inside system.
I. Install pressure gauges with shutoff valve and drain at service entrance to building.

J. Install chrome plated escutcheon plates at pipe penetrations of ceilings, floors and walls.

K. Firestop penetrations in accordance with Section 15140.

L. Install sprinkler cabinet in location directed by Owner.

3.3 INSTALLATION OF SPRINKLER HEADS

A. Do not install sprinkler heads through or with escutcheon plate covering suspended ceiling grids.

B. Locate heads centered in ceiling tile and in center of metal strip in linear metal ceilings. If such location makes added heads necessary, provide added heads as required to meet code.

C. Relocate heads if necessary to coordinate with ceiling layout.

D. Install sprinkler heads to provide and maintain minimum 18 IN clear between bottom of deflector and top of storage, files, shelving and cabinets.

3.4 ELECTRICAL WIRING

A. Electrical Contractor provide:
   1. Supervised wiring from water flow detector to outside alarm bell and fire alarm system control panel.
   2. Supervised wiring from valve tamper switches to fire alarm system control panel.

B. Sprinkler Contractor responsible for providing:
   1. Wiring diagrams for devices.
   2. Other wiring not specified to provide an operating system.

3.5 FIELD QUALITY CONTROL

A. Test sprinkler piping, including outside supplies, under hydrostatic pressure to 200 PSI for 2 hours.
   1. Prove system tight to satisfaction of Engineer/Architect.
   2. Inside piping shall show no leakage.
   3. Leakage in underground piping shall be in accordance with NFPA 24.

B. Test completed alarm systems including control and signal circuits wired by Electrical Contractor.
   1. Coordinate with electrical.
   2. Complete testing prior to acceptance by Owner.

C. Give advance notice and arrange for field tests and inspections by local authority.

END OF SECTION
SECTION 15410
PLUMBING PIPING –
PLUMBING, HVAC AND FIRE PROTECTION

PART 1 - GENERAL

1.1. WORK INCLUDES

A. Contractor provide:
   1. Domestic hot and cold water systems.
   2. Sanitary waste and vent piping system within building and to 5 FT outside of building wall.

1.2. QUALITY ASSURANCE

A. Pipe and fittings standards: See Section 15060.
B. Standard for sterilization: AWWA-C601.
C. Water-hammer arrestors standard: Plumbing and Drainage Institute Standard PDI-WH201.
D. All work shall comply with State of Florida and local Plumbing Codes.

1.3. SUBMITTALS (See Division 1)

A. Shop drawings: Not required for Engineer/Architect review.
B. Product data.
C. Samples: Not required for Engineer/Architect review.
D. Project information: Not required for Engineer/Architect review.
E. Contract closeout information:
   1. Pressure test reports.
   2. Disinfection test report.
   3. Operating and maintenance data.

PART 2 - PRODUCTS

2.1 GENERAL

A. Acceptable manufacturers:
   1. Shock absorbers:
      b. Wade.
      c. Jonespec.
      d. Josam.
      e. Zurn.
      f. Precision Plumbing Products.
g. Sioux Chief Manufacturing Co.

2. Floor and shower drains and cleanouts:
   a. Wade.
   b. Ancon.
   c. Josam.
   d. Jonespec.
   e. J R Smith.
   f. Zurn.

3. Other manufacturers desiring approval comply with Division 1.

2.2 PIPE AND FITTINGS

A. Domestic water piping:
   1. Hard Copper Tube: ASTM B 88, Type L water tube, drawn temper.

B. Domestic water piping at service entrance (from 1 FT inside building to 5 FT outside): Same as indicated for outside utilities.

C. Drainage piping below ground (soil and vent):
   1. Schedule 40 PVC with socket fittings and joints.

D. Drainage piping above grade (soil, vent, roof and area):
   1. Schedule 40 PVC with socket fittings and joints.

2.3 VALVES

A. General:
   1. Valves, 2 IN and less: 600 LB WOG bronze ball, standard port, 2 piece construction, anti-blowout stem, Teflon seats, stainless steel or chrome plated ball, extended stem, solder or 600 LB WOG bronze ball, standard port, 2 piece construction, anti-blowout stem, Teflon seats, stainless steel or chrome plated ball, extended stem, screwed.
   2. Unless otherwise indicated, provide valve on each branch serving a rest room.
   3. Provide valve on inlet and outlet of each equipment.
   4. Provide valves to isolate individual or group of fixtures and equipment on branch runouts from piping mains. This is in addition to valves at each fixture and equipment.
   5. Provide interior shut off and drain valve on each branch to wall hydrant or hose bibb.
   6. Provide valves as indicated and where required to adequately service parts of systems and equipment.

B. Check valves:
   1. 2 IN and smaller: 125 LB bronze check, horizontal swing, Y pattern, renewable bronze disc, solder or screwed.

2.4 FLOOR AND SHOWER DRAINS

A. As scheduled on drawings.

2.5 CLEANOUTS

A. Cleanouts:
1. For cast iron pipe: Tapped extra heavy cast iron ferrule, caulked into cast iron fittings, and extra heavy brass neoprene seal screw plug with solid hexagonal nut.
2. For steel pipe: Extra heavy brass screw plug in drainage fittings.
7. Cleanouts on lines in completely accessible pipe chases or in equipment rooms where piping is exposed do not require special covers.
9. Cleanouts for concrete or terrazzo finish: J.R. Smith 4020

B. Pipe fittings at cleanouts: Make cleanouts turning out through walls and up through floor by long sweep ells or "y" and 1/8 bends.

C. Cleanout cover plates:
   1. Provide face or deck plates for concealed cleanouts to conform to architectural finish in room.
   2. Where no definite finish is indicated provide chrome-plated cast brass wall plates and polished brass floor plates.

2.6 TRAPS

A. Traps:
   1. Cast brass, cast iron or PVC one piece pattern, 3 IN minimum seal.
   2. Same material and coating and finish as piping system into which they are installed except traps 2 IN IPS and under, not buried in earth, shall be cast brass.
   3. Provide trap cleanouts in accessible trap locations.

B. Traps for fixtures:
   1. Cast brass "P" traps with 2 IN minimum seal and gasketed cleanout plugs made of machined bar stock.
   2. Fixture trap modifications, where required, and sizes: As indicated or specified.

C. Traps for floor drains with outlet buried: Extra heavy cast iron or PVC P-traps, unless otherwise indicated.

2.7 OTHER MATERIALS

A. Pipe flashings:
   1. See Section 15010.
   2. Premolded or pre-fabricated pipe flashings.
   3. Coordinate with roofer.

B. Water-hammer arrestors:
   1. Provide PDI certified arrestors on hot and cold water lines in accordance with PDI-WH201 standard.
   2. Provide access doors if necessary to ensure accessibility for periodic service and maintenance.

C. Thermometers:
   1. See Section 15120.
   2. Provide where indicated.
D. Pressure gauges:
   1. See Section 15120.
   2. Provide where indicated.

E. Automatic air relief vents:
   1. See Section 15120.
   2. Provide at high points of piping.

PART 3 - EXECUTION

3.1 INSTALLATION OF WASTE AND DRAINAGE PIPING

A. Install piping as indicated and to provide every plumbing fixture and item of equipment requiring water, etc., with suitable soil, waste or vent connection, as required by governing code.

B. Install horizontal soil or waste lines to produce a flow of 2 FT per second or as indicated.
   1. Hold as close to construction as possible to maintain maximum head room.

C. Make changes of direction and junctions with Y fittings and 1/8 bends.
   1. Use short wye fittings in vertical pipe only.

D. Install handhole test tee at base of each stack.

E. Install cleanouts at deadends, at changes of direction and at 50 FT intervals on horizontal runs.
   1. Where cleanouts occur in concealed spaces, provide with extensions to floors above or to walls as required.

F. Connect equipment furnished under other divisions in accord with Section 15010.
   1. For each waste piping connection to equipment, if waste is connected directly to building sewer system, furnish and install a P-trap.
   2. Size trap as required by Plumbing Code.

G. Run a vent stack parallel to each soil or waste stack to receive branch vents from fixtures.
   1. Each vent stack shall originate from a soil or waste pipe at its base.

H. Carry each soil or waste stack and each vent stack through roof.

I. Where possible combine soil, waste or vent stacks before passing through roof so as to minimize roof openings.

J. Offset pipes running close to walls away from such walls before passing through roof to permit proper flashing.

K. Carry vent stacks 3 IN and larger full size through roof.

L. Extend vent stacks at least 12 IN above roofing.

M. Consult manufacturer's data and large scale details of rooms containing plumbing fixtures on Architectural Drawings before roughing-in piping.
   1. Plug or cap piping immediately after installation.
N. Trap fixtures as required by governing code.

O. Stub piping for equipment, sinks, lavatories, supply and drain fittings, keystone, P-traps, miscellaneous traps and miscellaneous brass through wall or floor.
   1. Cap and protect until such time as installation is performed.

P. Provide cleanouts on waste and drain lines as indicated and as required by governing code.
   1. Use cleanouts same size as pipe up to 6 IN, and not less than 6 IN for larger pipes.
   2. Install cleanouts where specified and as indicated, and as follows:
      a. Above floor in each vertical riser that connects to horizontal branch below floor.

3.2 INSTALLATION OF DOMESTIC WATER PIPING

A. General: See Section 15060.

B. Install piping as indicated and as required to provide suitable supply connections to each fixture and item of equipment requiring water supply.

C. Install plumbing without cross- or inter-connection between potable and non-potable lines.

D. Install pipe hangers as indicated in Section 15140.

E. Install escutcheons as indicated in Section 15440.

F. Install shock absorbers in easily accessible locations and install access doors.

G. Provide approved type vacuum breaker at plumbing fixtures and equipment as indicated or as required by Code.

H. Run piping concealed wherever possible.

I. Under no circumstances reduce pipe size indicated without written consent of Engineer/Architect; size supply branches to individual fixtures as indicated.

3.3 INSTALLATION OF FLOOR AND SHOWER DRAINS

A. Drains with outlet above ground:
   1. Provide 30 IN square lead flange.
   2. Install drains in mortar set quarry tile floors 1-1/2 IN above structural slab; in thinset: 1/2 IN.
   3. Set over drainage P-traps.

3.4 STERILIZATION OF DOMESTIC WATER SYSTEM

A. Sterilize system as indicated or in accord with AWWA-C652 or CS186.

B. Thoroughly flush potable water systems.

C. After flushing, introduce chlorine or chlorine compound into system with dosage sufficient to give an initial residual chlorine content of 50 PPM.

D. Collect samples from various taps and fixtures throughout buildings during introduction of chlorine to assure uniform distribution.
E. Open and close valves several times.

F. After a 24 hour contact period, flush traces of heavily chlorinated water from systems.

G. After flushing is complete, submit evidence of effectiveness of disinfection.
   1. Laboratory reports of bacteriological tests on samples taken from system.

H. If unsatisfactory results are obtained, repeat disinfection process until satisfactory.

I. Do not put system into service until tests are approved by County plumbing inspector.

3.5 TESTING OF DOMESTIC WATER SYSTEM

A. Upon completion of system or a section of system, test piping hydrostatically to pressure not less than 50 percent in excess of maximum pressure to which pipe will ordinarily be subjected, but in no case less than 200 PSI. Maintain pressure for 30 minutes.

B. Repair leaks or replace defective pipe disclosed by tests.

C. Repeat tests until piping shows tight.

D. Test shall be witnessed by Engineer. Contractor shall notify Engineer at least 24 hours in advance.

3.6 TESTING OF WASTE SYSTEMS

A. Do not insulate, conceal or fir in pipe until it has been tested to satisfaction of Owner and County Inspector. If inspection or test shows defects, replace such defective work or material and repeat inspection and tests.

B. Test piping at completion of installation of each stack or section of piping.
   1. Fill system with water to highest point and check joints and fittings for leaks.
   2. Eliminate leaks before proceeding with work or concealing piping.
   3. Minimum test height: 10 FT.
   4. Make repairs to piping with new material.
   5. No caulking of screwed joints or holes will be allowed.
   6. Maintain test for 30 minutes.
   7. Test shall be witnessed by Engineer. Contractor shall notify Engineer at least 24 hours in advance.

END OF SECTION
SECTION 15440

PLUMBING FIXTURES AND TRIM –
PLUMBING, HVAC AND FIRE PROTECTION

PART 1 - GENERAL

1.1. WORK INCLUDES

A. Contractor provide:
   1. Water closets and seats.
   2. Lavatories and fittings.
   3. Stainless steel sinks and fittings.
   4. Hose bibbs.
   5. Wall hydrants.
   6. Showers and fittings.
   7. Electric water cooler.
   8. Emergency shower.
   9. Thermostatic mixing valves

1.2. DEFINITIONS

A. Finished areas: Room or area that has finish called for on Room Finish Schedule.

1.3. SUBMITTALS (See Division 1)

A. Shop drawings: Not required for Engineer/Architect review.

B. Product data: Fixtures and trim.

C. Samples: Not required for Engineer/Architect review.

D. Project information: Not required for Engineer/Architect review.

E. Contract closeout information: Not required for Engineer/Architect review.

PART 2 - PRODUCTS

2.1 MATERIALS - GENERAL

A. Plumbing fixtures - general: Constructed with, or equipped with, anti-siphon devices to prevent siphoning waste material into potable water supply system.

B. Escutcheons and plates: Conceal holes where pipes pass through walls, floors or ceilings; use plates or escutcheons if necessary.

C. Exposed piping, fittings, and trimmings in finished areas: Chromium plated or nickel plated brass with polished bright surface.

D. Trim for lavatories, sinks, etc.: Provide with renewable cartridges.
E. Vitreous caps: Provide for water closet bolts.

F. Mixing valves: Provide with "Off-Cold-Hot" marking in block type letters, white on black field or black on white field, minimum 7/32 IN high.

G. Sealant: Silicone type. See Section 07920.

2.2 FIXTURES

A. As scheduled.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install fixtures in first class manner with proper connections to water, drainage and vent systems.

B. Install fixtures at manufacturer's height unless noted otherwise.

C. See that proper grounds are set to form a secure base for each fixture and an absolutely rigid setting.

D. Provide guards and boxing as may be required to protect fixtures against damage from operations of other trades.

E. Fixtures except tank type water closets shall have water supply above rim or with code approved backflow preventers.

F. Connect exposed traps and supply pipes for fixtures and equipment to rough piping systems at wall, unless otherwise specified.

G. Where plumbing fixtures abut to walls and floors, seal joints with sealant.

3.2 ADJUST AND CLEAN

A. Remove labels from fixtures, and clean prior to final acceptance.

B. Remove dirt from fixtures, fittings and traps.

C. Secure escutcheons against wall.

D. Adjust thermostatic mixing valves for a maximum delivered water temperature of 110°F.

END OF SECTION
SECTION 15450

DOMESTIC WATER HEATER –
PLUMBING, HVAC AND FIRE PROTECTION

PART 1 - GENERAL

1.1.  WORK INCLUDES

A.  Plumbing Contractor provide:
   1.  Domestic electric storage water heater.
   2.  Expansion tank.

1.2.  QUALITY ASSURANCE

A.  Factory testing: Subject tank and elements to hydrostatic test pressure, 150 percent in excess of working pressure. Certify that components are free of leaks.

1.3.  SUBMITTALS (See Division 1)

A.  Shop drawings: Not required for Engineer/Architect review.
B.  Product data: water heaters and expansion tanks.
C.  Samples: Not required for Engineer/Architect review.
D.  Project information: Not required for Engineer/Architect review.
E.  Contract closeout information:
   1.  Operating and maintenance data.
   2.  Owner’s instruction report.

1.4.  EXTENDED WARRANTIES

A.  Provide manufacturer’s 6-year warranty from date of installation for water heater tank.

PART 2 - PRODUCTS

2.1  ELECTRIC WATER HEATER (STORAGE)

A.  Type: Automatic, electric, vertical storage.
B.  Performance: As scheduled on Drawings.
C.  Electrical Characteristics:
   1.  208 volts, three phase, 60 Hz.
D.  Tank: Glass lined welded steel, thermally insulated with 2 inch thick glass fiber; encased in corrosion-resistant steel jacket; baked-on enamel finish.
E. Controls: Automatic water thermostat with externally adjustable temperature range to 140 degrees F, flanged or screw-in nichrome elements, enclosed controls and electrical junction box.

F. Accessories: Brass water connections and dip tube, drain valve, high-density magnesium anode, and ASME temperature and pressure relief valve with integral vacuum relief valve.

2.2 EXPANSION TANKS

A. Precharged (40 PSIG)

B. Steel tank with Butyl/EPDM diaphragm and polypropylene liner.

C. Brass pipe connection.

D. Rated for 150 PSIG working pressure and 200 degrees F.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install units in accord with manufacturer's instructions.

B. Coordinate with plumbing piping and related electrical work to achieve operating system.

C. Clean and flush tank after installation. Seal until pipe connections are made.

D. Pipe relief valves full size and terminate at floor drain with air gap.

END OF SECTION
SECTION 15530

REFRIGERANT PIPING SYSTEMS –
PLUMBING, HVAC AND FIRE PROTECTION

PART 1 - GENERAL

1.1 WORK INCLUDES

A. Contractor provide:
   1. Refrigerant piping.
   2. Refrigerant valves.
   3. Refrigerant specialties.

1.2 SUBMITTALS (See Division 1)

A. Shop drawings: Not required for Engineer/Architect review.
B. Product data:
C. Samples: Not required for Engineer/Architect review.
D. Project information: Not required for Engineer/Architect review.
E. Contract closeout information: Test reports.

PART 2 - PRODUCTS

2.1 MATERIALS - GENERAL

A. Furnish material and equipment from an established and reputable manufacturer.
B. Fittings and flanged unions shall be cast brass or wrought copper refrigeration type fittings. Cast fittings shall be internally tinned before use.

2.2 PIPE AND FITTINGS

A. Refrigerant piping
   1. All refrigerant piping shall be Type L ACR hard copper.
      a. For pipe runs and joints (copper to copper), Sta-Silv or Silfos, a solder composition with 15% silver (BCUP-S) shall be used.
      b. Where dissimilar metals are joined, such as copper to brass or copper to steel, Sta-Silv or “easy-flow”, a solder composition with 45% silver (BAg-1) shall be used.
      c. Where auxiliary components, such as expansion valves, are involved, Sta-brite (soft solder) with tin and 4% silver shall be used.
   2. When soldering, a nitrogen bleed shall be used to keep pipe and fitting from being oxidized.

B. For field assembled units, size refrigeration lines according to manufacturer’s published tables using pressure or temperature drops as follows:
1. Suction lines: 2 deg. F.
2. Liquid lines: 1 deg. F or 2 PSI.
3. Hot gas lines: 1 deg. F or 3.6 PSI.
4. Size discharge and hot gas risers for positive oil return to compressors.

C. Hangers: As specified in Section 15140.
   1. Install hangers over outside of insulation.
   2. Use copper or cadmium plated hangers when in direct contact with copper lines.
   3. Support piping as far as possible from equipment.

2.3 SPECIALTIES

A. Acceptable manufacturers:
   1. Refrigerant piping specialties:
      a. Alco.
      b. Refrigerating Specialties.
      c. Sporlan.
   2. Expansion valves:
      a. Alco.
      b. Refrigerating Specialties.
      c. Sporlan.
   3. Other manufacturers desiring approval comply with Division 1.

B. Moisture indicator: Show presence of moisture in system by change of color.
   1. Install adjacent to filter.
   2. In bypass line use Sporlan SA-12S.

C. Strainers: Design to permit removing screen without removing strainer from piping system.
   1. Provide with screens of not larger than 80 mesh.
   2. Provide strainers on liquid line serving each thermostatic expansion valve and in suction line serving each refrigerant compressor not equipped with integral strainer.

D. Oil traps:
   1. Provide in lines as indicated, and/or required by the manufacturer.

2.4 VALVES

A. Valves: Bronze
   1. In lines 2 IN and less: Solder ends.
   2. In lines 3 IN and over: Four bolt union ends.

B. Shut off valves: Packed type with gas tight cap seal and hard metal seats and shoulders which permit packing stuffing boxes wide open under pressure; or sealed diaphragm type.
   1. Wheel, globe, angle or "T" handle.

C. Check valves:
   1. In liquid lines 5/8 IN and less: Lift check type.

D. Expansion valves: Sized by manufacturer for refrigerant used.
   1. Provide one in each circuit with liquid distributor connection immediately after.

E. Vent and test valves: Angle cap type with seal and outlet caps.
PART 3 - EXECUTION

3.1 REFRIGERANT PIPING ASSEMBLY

A. The installation shall be made by experienced refrigeration mechanics. All refrigerant piping shall be cleaned, deoxidized, dehydrated, and sealed by the manufacturer before shipment. Ends shall remain sealed at all times until used.

B. Install in accord with Section 15060.

C. Thoroughly clean piping of dirt and grease on inside with a suitable cleaning solution just before soldering.

D. Polish end of tube and inside of fitting.

E. Purge refrigerant piping of air while connections of refrigerant piping are being made.
   1. Shut off valves.
   2. Connect tank of dry nitrogen to line on back side of valve.
   3. Introduce dry nitrogen into line as refrigerant piping joints are successively made up from valve to each condenser.

F. All piping to be silver brazed with 15% high temperature brazing.

G. Insulate in accordance with specification section 15250.

H. Vibration eliminators shall be located in the piping.

3.2 TESTING

A. Test refrigerant piping to hold pressure of twice normal working pressure for period of 72 hours before refrigerant is added.

B. Testing pressure shall not exceed maximum rating of weakest component of system.
   1. Use dry nitrogen gas for pressure testing.
   2. High side to be valved off and pressure tested at recommended pressures for R-410.
   3. Low side to be valved off and tested at recommended pressures.

C. Check joints with an electronic leak detector.

D. Cut out joints found to be leaky and replace with new material.
3.3 CLEANING

A. After complete system is tested, disconnect suction and discharge lines from compressor for cleanup.

B. Valve or blank off system into three separate systems for purpose of cleanup.
   1. Suction side including cooling coils.
   2. Discharge side including air cooled condenser.
   3. Hot gas reheat side including heating DX coils.

C. Thoroughly clean each system using Nitrogen, until system is proven clean to satisfaction of refrigeration compressor serviceman.

D. Notify Engineer for a visual inspection of both cleaning process and completely cleaned system.

3.4 EVACUATION AND DRYING

A. After tests and cleaning have been completed and system proved tight, charge each circuit with dry Nitrogen to approximately 50 psi of gas pressure.

B. Evacuate to 100 micron Hg and hold for 48 hours.
   1. Use laboratory type vacuum pump capable of holding absolute pressure of 50 micron Hg.

C. Admit another drying charge of Nitrogen and allow 4 to 6 hours to absorb moisture and install dryer cores.

D. Use second evacuation to remove Nitrogen and moisture.

E. After second evacuation, charge system with refrigerant.

F. Add refrigerant to system as required after final evacuation.

END OF SECTION
PART 1 - GENERAL

1.1. WORK INCLUDES
   A. Contractor provide:
      1. Direct expansion split system.
      2. Unitary ductless split air conditioners.

1.2. QUALITY ASSURANCE
   A. Units shall be factory tested and UL listed and ARI certified.

1.3. SUBMITTALS (See Division 1)
   B. Shop drawings: Not required for Engineer/Architect review.
   C. Product data.
   D. Samples: Not required for Engineer/Architect review.
   E. Project information: Not required for Engineer/Architect review.
   F. Contract closeout information:
      1. Operating and maintenance data.
      2. Owner instruction report.
      3. Test report.

PART 2 - PRODUCTS

2.1 UNITARY SPLIT SYSTEMS
   A. Acceptable manufacturers:
      1. Direct Expansion Split Systems:
         a. Carrier.
         b. Lenox.
         c. Trane.
         d. York.
      2. Unitary ductless split air conditioners:
         a. Carrier.
         b. Mitsubishi
         c. Sanyo.
         d. York.
   B. Other manufacturers desiring approval comply with Division 1.
2.2 DIRECT EXPANSION CONDENSING UNIT

A. Provide a complete factory assembled air-cooled heat pump unit, consisting of compressor, condenser coil and fan, and casing.
   1. Units: CSA and UL approved; conforming to ARI Standard 210.
   2. Minimum efficiencies: Minimum SEER and HSPF ratings shall not be less than scheduled on the drawings.
   3. Operating range: 0-115 deg F outdoor ambient.
   4. Provide factory installed filter-drier.

B. Compressor: Hermetic, welded shell-type.
   1. Motor: Wide operating range, dual voltage.
   2. Internal spring isolation and 2-stage sound isolation.
   3. Winding thermostat and current overload device coupled with pressure limiting valve.
   4. Internal protection devices for:
      a. Motor overload.
      b. Locked rotor.
      c. Extreme voltage supply.
      d. Excessive winding temperatures.
      e. Extreme pressures.
      f. Loss of refrigerant charge.
      g. Compressor cycling.
   5. Off cycle crankcase heater.

C. Coil, condenser: Seamless aluminum tubes, 3/8 IN OD, with aluminum fins mechanically bonded.
   1. Two row.
   2. Factory pressure and leak tested at 600 PSI.
   3. Provide heavy duty protective grille on every side.

D. Fan, condenser: Aluminum, aerodynamically designed, statically balanced.
   1. Motor: Single phase, direct drive, heavy duty, permanently lubricated, with built in thermal overload protection.
   2. Mount fan and motor support to cabinet top.
   3. Provide grille to protect fan.

E. Casing, condensing unit: 18 GA galvanized steel.
   1. Finish: Phosphatized; epoxy resin primer; acrylic finish coat.
   2. Removable end panel for access to components and connections.
   5. Drain holes in base pan.
   6. Electrical and refrigeration connections in same location on units.

F. Accessories:
   1. Provide extreme condition mounting kit for each condensing unit.
2.3 SPLIT SYSTEM AIR HANDLING UNIT

A. Provide a factory assembled air handling unit consisting of fan, motor, filters, evaporator coil, condensate drain pan, controls and an insulated casing.

B. Configuration Unit shall be convertible in the field for vertical or horizontal applications.

C. Fan:
   1. Forward curved.
   2. Dynamically balanced and statically balanced.
   3. 4 speed direct drive motor.
   4. Permanently lubricated fan motor bearings.
   5. Thermal overload protection.

D. Air Filter: 1" thickness throwaway type, slide-in/slide-out.

E. Unit Casing:
   1. Finish: Baked enamel, 20 GA steel.
   2. Lined with 1/2 IN thick, 1/2 PCF density neoprene coated insulation, with 4.2 R value.
   3. Removable access panels with quarter-turn fasteners.
   4. Knockouts for electrical power and control wiring.

F. Coil, evaporator: Seamless 3/8” O.D. copper tubes with aluminum fins mechanically bonded.
   1. Quick-connect male couplers.
   2. Expansion valve expansion device.
   3. Operating charge of refrigerant.

G. Heating elements, electric: Open type nickel-chromium alloy.
   1. UL approved.
   2. Cover 70%, minimum, of air outlet area, minimize bypass air and reduce coil surface temperatures.

H. Controls:
   1. Low voltage wire nut connections.
   2. Fan contactor.

2.4 DUCTLESS SPLIT SYSTEM CONDENSING UNITS

A. Condensing unit: Air-cooled condensing unit, factory assembled, consisting of compressor, condenser coil and fan, and casing.
   1. Units: CSA and UL approved; conforming to ARI Standard 210.
   2. Operating range: 0-115 deg F outdoor ambient.
   3. Factory installed filter drier.

B. Compressor: Hermetic, welded shell-type.
   1. Motor: Wide operating range, dual voltage.
   2. Internal spring isolation and 2-stage sound isolation.
   3. Winding thermostat and current overload device coupled with pressure limiting valve.
   4. Internal protection devices for:
      a. Motor overload.
      b. Locked rotor.
      c. Extreme voltage supply.
d. Excessive winding temperatures.
e. Extreme pressures.
f. Loss of refrigerant charge.
g. Compressor cycling.

5. Off cycle crankcase heater.

C. Coil, condenser: Seamless aluminum tubes, 3/8 IN OD, with aluminum fins mechanically bonded.
   1. Two row.
   2. Factory pressure and leak tested at 600 PSI.
   3. Provide heavy duty protective grille on every side.

D. Fan, condenser: Aluminum, aerodynamically designed, statically balanced.
   1. Motor: Two-speed, single phase, direct drive, heavy duty, permanently lubricated, with built in thermal overload protection.
   2. Mount fan and motor support to cabinet top.
   3. Provide grille to protect fan.

E. Casing, condensing unit: 18 GA galvanized steel.
   1. Finish: Phosphatized; epoxy resin primer; acrylic finish coat.
   2. Removable end panel for access to components and connections.
   5. Drain holes in base pan.
   6. Electrical and refrigeration connections in same location on units.

F. Accessories:
   1. Provide extreme condition mounting kit for each condensing unit.

2.5 DUCTLESS SPLIT SYSTEM INDOOR UNIT

A. Blower unit: Factory assembled; consisting of fan, filters, evaporator coil, controls and casing.

B. Fan, blower: Centrifugal type, direct drive.
   1. Motor: Two-speed, permanent split capacitor, with built in thermal overload protection and run capacitor.

C. Filter, blower: Throwaway type, slide-in/slide-out.

D. Casing, blower unit: 20 GA steel.
   1. Finish: Baked enamel.
   2. Lined with 1/2 IN thick, 1/2 PCF density neoprene coated insulation.
   3. Removable access panels with quarter-turn fasteners.

E. Coil, evaporator: Seamless copper tubes with aluminum fins mechanically bonded.
   1. Quick-connect male couplers.
   2. Expansion valve expansion device.
   3. Operating charge of R-22.
F. Controls, blower unit:
   1. Fan relay.
   2. 50 VA transformer.
   3. Thermostat: Cooling, for remote mounting.

2.6 PROGRAMMABLE THERMOSTATS

A. Provide a seven day programmable thermostat suitable for the packaged heat pump unit and
air handling unit.

B. Thermostat shall meet setpoint adjustment for unoccupied mode: heating down to 55
degrees and cooling up to 85 degrees and shall have a deadband range in compliance with
the applicable state energy code.

C. Thermostat shall be capable of automatically setting back or shutting down systems during
unoccupied hours using 7 different day schedules. Thermostat shall have an accessible 2-
hour occupant override and have a battery back-up capable of maintaining programmed
settings for at least 10 hours without power.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install units in accordance with manufacturer's instructions and recommendations.

B. Install condensing units on concrete pads and secure unit to pad with extreme condition
mounting kit and anchor bolts.

C. Connect all necessary refrigerant piping, fittings valves, etc., to provide a complete
installation as indicated and as specified. Where applicable, provide pre-charged, factory
assembled quick-connect refrigerant piping.

D. Provide insulation and jacketing for refrigerant suction line.

E. Install the control devices furnished by the manufacturer, but not specified to be factory
mounted in accordance with the manufacturer’s instructions, complete with control wiring
and conduit.

F. Connect humidity condensate drain and route condensate piping to floor drain or as
otherwise indicated on the drawings. Trap shall be adequately sized to properly drain
condensate.

G. Provide control wiring between components for control functions.

H. Power wiring shall be by Electrical Contractor.

END OF SECTION
SECTION 15870

EXHAUST AND VENTILATING FANS –
PLUMBING, HVAC AND FIRE PROTECTION

PART 1 - GENERAL

1.1. WORK INCLUDES

A. Contractor provide:
   1. Propeller fans.
   2. In-line centrifugal fans.
   3. Gravity ventilators

1.2. QUALITY ASSURANCE

A. Standards:
   1. ADC Standard 1062R2, Air Diffusing Equipment Test Code.
   2. AMCA Standard 210, Test Code for Air Moving Devices.

1.3. SUBMITTALS (See Division 1)

A. Shop drawings: Not required for Engineer/Architect review.

B. Product data:
   1. Fan curves.
   2. Sound data.
   3. Motor data
   4. Accessories furnished.

C. Samples: Not required for Engineer/Architect review.

D. Project Information: Not required for Engineer/Architect review.

E. Contract closeout information:
   1. Operating and maintenance data.
   2. Owner instruction report.
PART 2 - PRODUCTS

2.1 GENERAL

A. Acceptable manufacturers:
   1. Propeller fans:
      a. Carnes.
      b. Acme Engineering and Manufacturing Corp.
      c. Loren Cook.
      d. Hartzell Fan Inc.
      e. ILG Industries.
      f. New York Blower.
      g. Peerless-Winsmith Inc.
      h. Penn Ventilator Co.
      i. Greenheck Fan Corp.
   2. In-line centrifugal fans:
      a. Carnes.
      b. Loren Cook.
      c. New York Blower.
      d. Penn Ventilator Co.
      e. Twin City Fan and Blower Co.
      f. Acme Engineering and Manufacturing Co.
      g. Greenheck Fan Corp.
   3. Gravity roof ventilators:
      a. Carnes.
      b. Aerovent Inc.
      c. Acme Engineering and Manufacturing Corp.
      d. Cesco-Advance Air.
      e. Jenn Industries Inc.
      f. Loren Cook Co.
      g. Penn Ventilator Co.
      h. Greenheck Fan Corp.
   4. V-belt drives:
      a. Browning-Morse.
      b. Gates.
      c. Masko.
   5. Other manufacturers desiring approval comply with Division 1.

B. Fans - General:
   1. Performance ratings: Based on laboratory tests conducted in accordance with latest edition of ASHRAE/AMCA Standard Test Codes.
   2. Ratings: As indicated on the drawings.
   3. Arrangement and drive: As indicated on the drawings.
   4. Finish: Unless otherwise noted, applied enamel on all housings consisted of non-aluminum materials, and mill finish on all housings constructed of aluminum.

2.2 PROPELLER FANS

A. General:
   1. Direct or belt drive, AMCA labeled.
   2. Fan capacity and RPM: As indicated.
3. Fan blades and hubs: Cast aluminum type, or 2-piece die formed hubs and blades, using welded construction with blades reinforced with gussets or of air foil design and rigidity; designed for low noise operation.

4. Propeller assembly reinforced to prevent distortion.

5. Statically and dynamically balanced.

6. Motor and drive: Isolate from enclosure by rubber-in-shear or spring type vibration isolators standard with manufacturer.
   a. For direct drive fans, resiliently mounted motors may be used.

7. Motors and drives shall be TEFC construction.

B. Wall mounted fans:
   1. Support on heavy metal frames designed for wall opening.
   2. Provide self acting backdraft dampers for exhaust fans.
   3. Mounting ring or plate: Extended type to provide suitable support for motor.
   4. Speed: Not over 1800 RPM.
   5. Safety guard: Stiff woven wire, or other standard construction.

2.3 IN-LINE FANS

A. Centrifugal, direct driven type.

B. Capacity: Not less than scheduled on the drawings.

C. Housing: Galvanized steel lined with acoustical insulation.
   1. Integral backdraft damper at fan discharge.

D. Fan: Forward curved centrifugal wheel mounted on motor with fan shrouds.

E. Motor: Permanent split capacitor or capacitor start, induction run.
   1. Permanently lubricated bearings.
   2. Provide with overload protection.
   3. Provide vibration isolation on motor fan assembly.

F. Electrical: Provide junction box for electrical connection on housing and receptacle for motor plug-in.

G. Provide duct collar connections.

2.4 GRAVITY ROOF VENTILATORS

A. Size and type: As indicated.

B. Housings:
   1. Aluminum construction.
   2. Capable of withstanding 140 MPH wind.
   3. Provide with aluminum bird screens.

C. Provide factory prefabricated, insulated roof curbs.
   1. Curb height: 12 IN, above finished roof.
   2. Type to suit roof construction and provide water tight enclosure.

2.5 VIBRATION ISOLATION

A. See Section 15240.
PART 3 - EXECUTION

3.1 INSPECTION: Examine areas and conditions under which fans shall be installed. Do not proceed with work until unsatisfactory conditions have been corrected.

3.2 INSTALLATION (GENERAL): Install fans where indicated, in accordance with equipment manufacturer's installation instructions, and with recognized industry practices, to insure that equipment complies with requirements and serves intended purposes. Install fans with recommended clearances provided for service and maintenance.

3.3 ELECTRICAL CONNECTIONS: Ensure that fans and components are wired properly, with rotation in direction indicated and intended for proper performance. Furnish to Electrical Installer, manufacturer’s wiring diagram and electrical requirements for installation of field-wiring required for equipment (including control panels); not work of this section.

3.4 FIELD QUALITY CONTROL: Upon completion of installation of fans, and after motors have been energized with normal power source, test equipment to demonstrate compliance with requirements. Where possible, field correct malfunctioning equipment, then retest to demonstrate compliance. Replace equipment which cannot be satisfactorily corrected.

3.5 INSTALLATION OF FANS:

A. Coordinate with other work, including ceiling, wall and roof construction and electrical work as necessary to interface installation.

B. Hang units from structure, where required, using threaded rods and building attachments, secure rods to unit hanger attachments. Adjust hangers so unit is plumb and level. Install vibration isolation devices as furnished with the unit or specified in Section 15240.

C. Install all accessories, shipped loose such as speed controls, motorized dampers, shutters, vibration isolators, etc.

D. Do not operate units for any purpose, temporary or permanent, until ductwork is clean, bearings lubricated, and fan has been test run under observation.

E. Furnish electrical field-wiring diagrams to Electrical Contractor for power wiring of fan motor and motorized damper.

END OF SECTION
1.1. WORK INCLUDES

A. Contractor provide:
   1. Low pressure ductwork, fittings and accessories.
   3. Fire dampers
   4. Diffusers, registers and grilles.
   5. Silencers

B. Definitions:
   1. Low pressure ductwork: 2500 FPM velocity or less and static pressure 2 IN WG or less.
   2. Gage:
      c. Steel wire: Washburn and Moen Gage.
   3. Concealed insulated surfaces: Piping, ductwork and equipment in walls, partitions, floors, pipe chases, pipe shafts, duct shafts, sealed alleyways, and above suspended ceilings.
   4. Exposed insulated surfaces: Piping, ductwork and equipment located in mechanical rooms, tunnels and rooms without suspended ceilings.

C. Drawings show tentative arrangement of partitions, diffusers and lights.
   1. Final location of diffusers, registers and grilles: Architectural reflected ceiling plans.

1.2. QUALITY ASSURANCE

A. Design and installation standards:
   2. ADC Test Code FD 72-R1, Flexible Air Duct Test Code.
   5. ASHRAE Guide and Data Book - Equipment, current chapter on duct construction.
   10. Underwriters Laboratory – UL 181, Duct Liner Erosion Test.

B. Fire and smoke rating test standards: ASTM-E84, NFPA 255 and UL 723.

C. Duct sizes indicated are internal sizes.
D. Installer: A firm with at least five (5) years of successful installation experience on projects with ductwork systems work similar to this project.

1.3. SUBMITTALS (See Division 1)

A. Shop drawings: Not required for Engineer/Architect review.

B. Product data:
   1. Submit manufacturer's data on diffusers and grilles, including the following:
      a. Schedule of diffusers and grilles indicating drawing designation, room location, number furnished, model number, size and accessories furnished.
      b. Data sheet for each type of diffuser and grille, and accessory furnished; indicating construction, finish and mounting details.
      c. Performance data for each type of diffuser and grille furnished, including air flow capacity, throw and drop, and noise criteria ratings. Indicate selections on data.

C. Samples: Not required for Engineer/Architect review.

D. Project information: Not required for Engineer/Architect review.

E. Contract closeout information:
   1. Operating and maintenance data.
   2. Test reports.

1.4. DELIVERY, STORAGE AND HANDLING:

A. Protect fabricated ductwork, accessories and associated products from damage during shipping, storage and handling. Prevent end damage and prevent dirt and moisture from entering ducts and fittings.

B. Where possible, store air distribution and treatment products inside and protect from weather. Where necessary to store outside, store above grade and enclose with waterproof wrapping.

C. Deliver diffusers and grilles wrapped in factory-fabricated fiberboard containers. Identify on outside of container, type of diffuser or grille and location to be installed. Avoid crushing or bending and prevent dirt and debris from entering and settling in devices.
PART 2 - PRODUCTS

2.1 MATERIALS - GENERAL

A. Acceptable manufacturers:
   1. Duct sealer:
      a. Durkee-Atwood.
      b. Hardcast Inc.
      c. United McGill Corp.
      d. Foster Products Division, H B Fuller Co.
   2. Duct sealing tape:
      a. Durkee-Atwood.
      b. Hardcast Inc.
      c. United McGill Corp.
   3. Turning vanes:
      a. Aero-Dyne.
      b. Airsan.
      c. Tuttle and Bailey.
      d. Titus.
      e. Vent Products Co.
   4. Flexible fan connections:
      a. Duro-Dyne.
      b. Elgin.
      c. Ventfabrics.
   5. Flexible duct:
      a. Acme Manufacturing Co.
      b. CertainTeed Corp.
      c. Clevepak Corp., Clevaflex Division.
      d. General Flex Corp.
      e. Goodman Manufacturing Corp.
      g. H K Porter Co., Inc., Thermoid Division.
   6. Manual dampers:
      a. Air Balance, Inc.
      b. American Warming & Ventilating Co.
      c. Ruskin Manufacturing Co.
      d. Safe-Air Inc.
      e. Vent Products Co.
   7. Fire dampers:
      a. Air Balance, Inc.
      b. American Warming & Ventilating Co.
      c. Arrow United Industries Inc.
      d. Greenheck.
      e. Nailor-Hart Industries Inc.
      f. National Controlled Air.
      g. Phillips-Aire.
      h. Prefco Products.
      i. Ruskin Manufacturing Co.
      j. Safe-Air Inc.
8. Diffusers, registers and grilles:
   a. Hart and Cooley.
   b. Krueger.
   c. Price.
   d. Titus.
9. Silencers:
   a. Industrial Acoustics, Co.
   b. Rink Corp.
   c. Semco.
   d. Titus.
   e. United McGill Corp.
   f. Vibro-Acoustics.
10. Other manufacturers desiring approval comply with Division 1.


C. Duct sealer: NFPA rating of "Non-Combustible".
   1. Flame spread rating: 25 or lower, in dry condition.
   2. Smoke developed rating: 50 or lower, in dry condition.
   3. Resistant to water and water vapors.
   4. Pressure rupture rating: 16 IN water gauge, minimum.
   5. Durkee-Atwood, Permatite Class I; Hardcast 601; or United McGill, Uni-Grip Duct Sealer.
   6. Flanged Joint Mastics: One part, acid-curing, silicone, elastomeric joint sealants, complying with ASTM C 920, Type S, Grade NS, Class 25, Use O.

D. Duct sealing tape: NFPA rating of "Non-Combustible".
   1. Flame spread rating: 25 or lower, in dry condition.
   2. Smoke developed rating: 50 or lower, in dry condition.
   3. Adhesive: Specifically compounded for maximum adhesion to galvanized and stainless steel.
   4. Durkee-Atwood "Insta-Seal" Class I; Hardcast P301; Tremco 440; or United McGill, Uni-Cast tape.
   5. Where exposed: 15 mils of elastomeric modified butyl adhesive on 2 mil foil backing. Tape shall comply with U.L. 181B-FX.

E. Ductwork Support Materials: Furnish and install galvanized steel fasteners, anchors, rod, straps, trim and angles for support of galvanized steel ductwork.

2.2 DUCTWORK - GENERAL

A. Exposed Ductwork Materials: Where ductwork is indicated to be exposed to view in occupied spaces, provide materials which are free from visual imperfections including pitting, seam marks, roller marks, oil canning, stains and discolorations, and other imperfections, including those which would impair painting.

B. Except as otherwise indicated, fabricate ductwork from galvanized sheet steel complying with ANSI/ASTM A 653 LFQ (lockforming quality) with ANSI/ASTM A 526, G 90 zinc coating; mill phosphatized for exposed locations.

C. Sound Absorbing Liner For Ductwork: All ductwork which communicates to the outdoors, serving outside air louvers, exhaust louvers, etc. shall be lined with 1" thickness closed cell elastomeric
insulation, Armstrong Armaflex II foam plastic sheet insulation; material installed in 2 layers with joints staggered.

2.3 DUCTWORK – LOW PRESSURE

A. General
1. Maintain full areas and suitable shapes at every point.
2. Shapes may be changed to fit unusual space conditions, with Engineer’s approval.
3. Provide necessary transitions and offsets to complete systems.
4. At register runouts, round ducts having equal area or greater may be used, provided the low-
   loss taps are used and system meets pressure test requirements.
5. Provide manual volume dampers at all supply branch lines whether shown or not on contract
   drawings.

B. Ductwork, low pressure, sheet metal:
1. Low pressure ductwork includes but is not limited to:
   a. Ductwork on outlet side of single duct air terminal units and air pressure reducing valves.
   b. Parts of supply, return, exhaust and relief air ductwork as indicated.
2. Construct in accord with latest SMACNA HVAC Duct Construction Standard as follows:
   a. Rectangular duct: 2 IN WG static pressure, positive or negative (for the entire
      rectangular duct system).
   b. Round duct: 2 IN WG static pressure, positive or negative.
3. All ducts shall be properly braced, stiffened, and/or cross broken so that no pulsation or
   rattling will occur. Bracing and stiffening material shall be galvanized steel on galvanized
   ducts. Transverse joints and bracing shall be as recommended in the latest edition of the
   SMACNA duct manual.
4. All seams in ductwork shall be locked and hammered flat and made absolutely tight against
   air leakage, joints shall be lapped with inside lap in direction of air travel and sealed with
   tape. Sufficient slip joints shall be installed in ducts to take care of expansion and
   contraction.
5. For supply, return, exhaust and relief ducts with longest side 26 IN and over: Construct
   using Ductmate; Nexus; Quicduc; Transverse Duct Connection (TDC); or Pyramid-Lok duct
   connection systems.
   a. Seal flanged ends with pressure sensitive, high density, closed cell, neoprene or
      polyurethane tape gasket or “Tremco 440”.
   b. For smaller duct sizes (longest side 25 IN or less): Above systems are optional.
6. Runouts to diffusers, register and grilles: May use flexible ducts.
   a. Exception: Flexible ducts may not pass through smoke or fire rated walls, floors or
      ceilings.
   b. Maximum flexible duct length: 3 FT.
   c. Minimum turning radius: As recommended by manufacturer.
   d. Flexible ducts are not permitted above restroom/shower room ceilings as well as any
      drywall ceiling areas.
7. Exposed low pressure:
   a. Exposed low pressure rectangular ductwork shall be constructed of galvanized sheet
      metal with a “paint grip” finish. Constructed ductwork shall be free of defects, which
      would inhibit painting.

C. Duct hangers and supports: In accord with following:
1. Low pressure ductwork (sheet metal): SMACNA HVAC Duct Construction Standard,
   Section IV.
D. Duct fittings and joints on low pressure systems:
   1. Radius elbows without vanes: Radius ratio (R/W) of 1.5 and greater.
   2. Radius elbows with vanes: Radius ratio (R/W) less than 1.5; use where space limitations occur.
      a. R/W = 0.75 to 1.0: Provide 3 vanes in elbow.
      b. R/W = 1.0 to 1.25: Provide 2 vanes in elbow.
      c. R/W = 1.25 to 1.5: Provide 1 vane in elbow.
      d. Provide vane spacing per Figure 2-5, SMACNA HVAC Duct Construction Standards.
   3. Where square elbows are indicated or required, provide with turning vanes.
   4. Connections to diffusers, grilles and registers: Fitted securely to necks or collars provided behind diffuser, grille, or register face area.
   5. Branch connections:
      a. Round: Factory built short cone or bellmouth type.
      b. Rectangular: 45 degree entry type or radius elbow.
   6. Provide necessary transition pieces and duct collars to make connections to ductwork from neck sizes scheduled or shown on drawings.
   7. Where building walls, floor and ceilings form portions of duct or plenum, provide gasketed angles or channels at junction points, securely bolted to building structure.

E. Turning vanes: For square elbows.
   1. Velocities up to 2500 FPM: Single vane, runner Type 2, with 3/4 IN trailing edge, 2 IN vane radius and 1.5 IN vane spacing, minimum 24 GA.
      a. For widths over 36 IN install vanes in 2 or more sections or use tie rods to limit unbraced vane length.
   2. Where inlet and outlet dimensions of elbows are not equal, set 2 or more sections at 45 degrees angle to give optimum turning as detailed on sheet metal drawings.

2.4 DUCTWORK ACCESSORIES

A. Flexible ducts, preinsulated:
   1. Low pressure construction:
      a. Spiral wire or band, reinforced fabric liner.
      b. Nominal 1 IN x 3/4 PCF fiberglass insulation insulation sheathed in a vapor barrier of aluminum metallized polyester film laminated to glass mesh elastomer backed coated barrier.

2.5 DAMPERS

A. Dampers, manual (rectangle and square):
   1. Opposed blade type, fitted with shank bolts, marked for direction (open/closed).
   2. Provide for double socket wrenches to fit square shank and locking hex nut.
   3. Construction: Heavy black iron frames, flat or angle iron, with blades of 16 GA galvanized steel, equipped with brass pin running on stainless steel pivot for vertical axis.

B. Damper, manual (round)
   1. Butterfly type with circular blade mounted to shaft.
   2. Frame: Minimum 14 GA galvanized steel channel.
   4. Axle: 1/2 IN diameter.
   5. Bearings: Self-lubricating nylon or stainless steel sleeve.
2.6 FIRE DAMPERS

A. Fire dampers - general:
1. UL labeled, 1-1/2 HR rated (unless otherwise indicated), 165 deg F fusible link.
2. Provide where indicated and where required by NFPA and local regulations.
3. Provide with mounting angles and sleeves.
4. Blades must be out of air stream.

B. Fire dampers in low pressure ducts (passing through 2 HR rated walls):
1. Multiblade for openings over 12 x 12 IN, single blade for openings 12 x 12 IN and less.
   a. Multiblade dampers: Blades must be out of air stream.
2. In small ducts, 8 IN and less: 1 IN larger in each dimension to give total loss through damper of 0.10 IN WG or less.
3. Air Balance, Inc., Model 119 or Ruskin Model IBD.

C. Fire dampers in high pressure ducts (passing through 2 HR rated walls)
1. With sleeve and adapter fittings on each side of sleeve.
2. Air Balance, Inc., Model 119 or Ruskin Model IBD.

D. Fire dampers for fume hood exhaust system:
1. Special type 316 stainless steel construction.
2. Blades, slide, and other parts with close tolerances: 20 GA.
3. Frame and collar: 18 GA.

2.7 DIFFUSERS, REGISTERS AND GRILLES

A. Diffusers, ceiling
1. Size, type and manufacturer: As scheduled on the drawings.
2. Finish of aluminum units: Factory applied, baked or electrocoated enamel; color as selected by Architect or as indicated on the drawings.
3. Provide sponge rubber gasket for ceiling diffusers.
4. Provide necessary screws, duct collars, transitions and air pattern deflectors.
5. Paint interior of supply and return diffusers and ductwork flat black where it is visible from finished spaces, or as directed by Engineer/Architect.
6. Provide in areas with lay in ceilings: Nominal 12 x 24 in; and 24 x 24 panel style diffusers.
7. Provide in areas with gypsum board ceilings: 12 x 24 in; and 24 x 24 in face.
8. Provide opposed blade dampers.
9. Provide easily removed inner core with a positive lock.

B. Diffusers, sidewall
1. Size, type and manufacturer: As scheduled on the drawings.
2. Finish of aluminum units: Factory applied, baked or electrocoated enamel; color as selected by Engineer/Architect or as indicated on the drawings.
3. Sponge rubber gasketed for ceiling and wall units.
4. Provide necessary screws, duct collars and transitions.
5. Provide air extractors for side wall grilles.

2.8 SILENCERS

A. Silencers:
1. Prefabricated, straight thru design.
2. Airflow pressure drop and noise reduction (NR) values as indicated on drawings.
3. Size and shape as indicated on drawings.
5. Interior partitions or splitters: 24 GA, minimum, perforated galvanized steel.
6. Aluminum construction: At least 50 percent thicker than steel specified.
7. Use straight thru, relatively narrow air passages.
8. Use airtight construction.
   a. Make unit leakproof when subjected to differential air pressure of 10 IN WG between outside and inside.
   b. Weld lock joints or seams or fill with mastic.

B. Silencers, noise reduction (NR) rating:
   1. In third octave band (180 to 355 cps).
   2. Tests made in such manner as to eliminate end reflections, beaming or directivity, flanking, standing waves, and rooms absorptions.
   3. Test method may be either "in-duct with anechoic termination" or "reverberant rooms with tunnel between".
   4. Size of units tested: Not smaller than 24 x 24 IN rectangular or 24 IN round outside, with full size connections.
   5. Submit corroborative report of tests made in nationally recognized, qualified, independent testing laboratory approved by AMCA for airflow determinations.

C. Silencers, airflow pressure drop rating:
   1. Do not exceed pressure drop at specified airflow(s).
   2. Base rating on results of tests made in manner to provide reliable data.

D. Silencer, acoustical fill:
   1. Inert, vermin and moisture proof, inorganic glass or - mineral fiber.
   2. Density: 4 PCF, minimum.
   3. Pack behind partitions or splitters under not less than 5 percent compression to provide "spring" and avoid settling.

PART 3 - EXECUTION

3.1 DUCTWORK FABRICATION

A. General:
   1. The drawings show the general layout of ductwork and accessories but do not show all required fittings and offsets that may be necessary to connect ducts to equipment, air terminals, diffusers, grilles, etc., and to coordinate with other trades. Fabricate ductwork based on field measurements. Provide all necessary fittings and offsets at no additional cost to the Owner. Coordinate with other trades for space available and relative location of HVAC equipment and accessories on ceiling grid. Duct sizes on the drawings are inside dimensions, which shall be altered by Contractor to other dimensions with the same air handling characteristics where necessary to avoid interferences and clearance difficulties.
   2. Provide duct transitions, offsets and connections to dampers, coils, and other equipment in accordance with SMACNA Standards, Section II. Provide streamliner, when an obstruction cannot be avoided and must be taken in by a duct. Repair galvanized areas with galvanizing repair compound.
3. Install duct hangers and supports in accordance with SMACNA Standards, Section IV.
4. Install fire dampers in accordance with the manufacturer's instructions to conform to the installation used for the rating test.
5. Seal openings around duct penetrations of floors and fire rated partitions with fire stop material as required by NFPA 90A.
6. Make duct connections from hoods, openings, fans, and other devices.
7. Provide fan discharge ductwork, minimum 30 IN straight run from fan discharge flange.
   a. 30 IN straight run may include flexible connections and transitions.
   b. In built-up air handling units, provide 30 IN of space from fan discharge flange to unit partition wall, minimum.
   c. Coordinate fan arrangement with duct discharge routes.
8. Install ductwork for kitchen exhaust systems in accordance with NFPA 96 and Uniform Mechanical Code.
9. Where ducts pass thru fire rated and smoke rated construction, maintain rating indicated.
   a. Where fire dampers are not used, seal around duct with firestopping.
   b. See Division 7 for materials.

B. Sheet Metal (Low Pressure):
1. Sheet metal shall be fabricated air tight and light proof and shall be free of vibration and sag. Pittsburgh Lock Machine, if used, shall be kept in first class working order with rollers properly maintained so that no excessive peeling off of galvanized coating on metal will occur.
3. Cross Breaking or Cross Beading: Cross break or cross bead duct sides 19 inches and larger and 0.0359 inch thick or less, with more than 10 sq. ft. of unbraced panel area, unless ducts are lined.
4. All elbows shall have a throat radius equal to the width of the duct wherever possible. Turning vanes shall be installed in all square elbows. Horizontal ducts over 400 square inches in cross-sectional area shall be supported from overhead structure members by ¾” x 1/8” strap iron. Horizontal ducts under 400 square inches in cross-sectional area shall be supported from overhead structure with the use of 1” wide 18-gage galvanized metal straps.
5. Seal all joints in rectangular supply, return, exhaust and outside air ductwork with duct sealing tape and adhesive, installed in strict accordance with manufacturer's instructions. Clean all dirt, oil, moisture, etc., from surfaces before applying adhesive.
6. Low pressure round ductwork shall be constructed and installed where shown on the plans. Ducts shall be constructed as called for in the latest edition of SMACNA “Duct Construction Standards” (Low Pressure). Longitudinal seams shall be Acme lock grooved seam type and joints shall be crimp and bead type. In lieu of crimp and bead joints, cement all seams, join with sheet metal screws and wrap duct tape over screws and cement.
7. Joining and Attaching Flexible Duct:
   a. Collars to which flexible duct is attached shall be a minimum of 2” in length. Sleeves used for joining two sections of flexible duct shall be a minimum of 4” in length.
   b. Collars and sleeves shall be inserted into flexible duct a minimum of 1” before fastening.
   c. Non metallic flexible duct shall be secured to the sleeve or collar with a draw band. If the duct collar exceeds 12” in diameter the draw band must be positioned behind a bead on the metal collar. One complete wrap of 3” wide aluminum tape shall be applied over draw band.
   d. Insulation and vapor barriers on factory fabricated flexible ducts shall be fitted over the core connection and shall also be secured with a draw band. One complete wrap of 3”
wide aluminum tape with 15 mils of modified butyl adhesive on 2 mil foil backing, complying with UL181 BFX, shall be applied over draw band and at the connection between the insulation of the flexible duct and the insulation of the metal duct.

e. All flex duct connections shall be installed to ADC Standards and sealed to UL 181 standards per AMC 603 and 604.2.1

8. Supporting Flexible Duct:
   a. Flexible ducts shall be supported at the manufacturer's recommended intervals but at least every 10'. Maximum permissible sag shall be 1/2 inch per foot of spacing between supports. A connection to another duct or to equipment shall be considered a support point. Hangers shall be adequately attached to the building structure.
   b. Hanger or saddle material in contact with the flexible duct shall be wide enough so that it does not reduce the internal diameter of the duct when the supported section rests on the hanger or saddle material. In no case will the material contacting the flexible duct be less than 1-1/2'' wide. Narrower hanger material may be used in conjunction with a sheet metal saddle that meets this specification. This saddle must cover one-half the circumference of the outside diameter of the flexible duct and fit neatly around the lower half of the duct's outer circumference.
   c. To avoid tearing the vapor barrier, do not support the entire weight of the flexible duct on any one hanger during installation. Avoid contacting the flexible duct with sharp edges of the hanger material. Damage to the vapor barrier may be repaired with 3'' wide aluminum tape with 15 mils of modified butyl adhesive on 2 mil foil backing, complying with UL181 BFX. If the internal core is penetrated, replace the flexible duct.
   d. Terminal devices connected by flexible duct shall be supported independently of the flexible duct.

3.2 INSTALLATION OF DUCTWORK ACCESSORIES

A. Where diffusers, registers and grilles cannot be installed to avoid seeing inside the duct, paint the inside of the duct with flat black paint to reduce visibility.

3.3 INSTALLATION OF FIRE DAMPERS

A. Install in accordance with manufacturer's instructions.

B. Seal fire dampers at wall or floor opening and between damper and sleeve or duct around one side of damper's downstream face.
   1. Systems as indicated in Division 7.

3.4 CLEANING

A. At completion of work and prior to final acceptance, clean work installed under this section.

3.5 EQUIPMENT DEMONSTRATION

A. Prior to final acceptance, inspect and test, and operate satisfactorily, in presence of Engineer and representative of Owner, operation of each piece of equipment and its accessories.

B. If inspection or test shows defects, replace defective work or material.

C. Repeat inspections and tests until defects are eliminated.

END OF SECTION
PART 1 - GENERAL

1.1. WORK INCLUDES

1. Contractor shall furnish and install a complete automatic temperature control system including all control wiring, conduit and field equipment. System shall provide for the automatic control and monitoring of the following systems and equipment: packaged air handling unit, condensing unit and reheat coil. All equipment and software shall be the most recent technology released by the manufacturer.

1.2. GENERAL

A. Definition:

1. Accessible locations: Behind control panels and other locations that are accessible for replacement.


C. Communications Cabling: Cabling for EMS trunk and EMS LAN shall be installed in EMT conduit. Cable sizes, quantities, and types shall be suitable for the application. Cabling shall be fully tested after installation for integrity, accurate data transfer, and interference.

D. Control Wiring: Control wiring shall be numbered at all terminations in accordance with the submitted diagrams. Control wiring shall be installed in EMT conduit (even the control wiring above suspended ceilings). Wiring shall be installed in accordance with the National Electric Code.

1.3. QUALITY ASSURANCE:

A. Materials and equipment shall be the products of manufacturers regularly engaged in the production and installation of temperature control systems. Materials and equipment shall be the manufacturer’s latest standard design that complies with the specifications.

B. Control system shall be installed using competent workmen who are fully trained in the installation of temperature control equipment.

C. All electronic equipment shall conform to the requirements of FCC Regulations, Part 15, Section 15, governing radio frequency and electromagnetic interference and shall be so labeled.

D. All system components shall be designed to be fault tolerant. Components shall operate in a satisfactory manner and without damage at plus 10% to minus 15% rated voltage and plus 3% to minus 3% line frequency. All inputs and outputs shall be equipped with static, transient, and short-circuit protection.
1.4. SUBMITTALS (See Division 1):

A. Shop drawings:
   1. Control wiring and piping diagrams including sequence of controls.
   2. Wiring diagrams.

B. Product data: Provide data for all devices required.

C. Samples: Not required for Engineer/Architect review.

D. Project information:
   1. Certification of installer qualifications.

E. Contract closeout information:
   1. Operating and maintenance data.
   2. Owner's instruction report.

F. Warranties: Provide one (1) year minimum material and labor warranty on all components from date of substantial completion.

PART 2 - PRODUCTS

2.1 CONTROL SYSTEM

A. Acceptable manufacturers:
   1. Control devices may be of varied manufacturers whose products are capable of meeting performance requirements.
   2. System Contractor is responsible for quality and satisfactory operation of devices, and for overall performance of system.

B. Temperature control system: Automatic, electric temperature control.
   1. Include:
      a. Sensors.
      b. Switches.
      c. Relays.
      d. Other associated controls required to maintain conditions described on the drawings.
   2. Provide complete system of wiring as necessary to fill intent of these specifications.
   3. Control sequences indicated illustrate basic control functions only.
   4. Provide additional controls, such as space temperature control, required to meet the intent of these specifications and make a complete system.

C. Electrical drawings indicate type of motor control required by equipment.

2.2 SENSORS

A. Temperature sensor shall have LCD display and key pad. System shall have seven day
programming capability either through a separate programmable panel or as part of the temperature sensor.

B. Humidity sensor:
   1. Wall mounted room humidity sensor shall be furnished with an accuracy of no less than plus or minus 2%.
   2. Unit shall be capable of field calibration with a portable service tool.

2.3 RELAYS AND SWITCHES

A. Control Relays: Coil voltages, contact arrangements and contact ratings shall be suitable for the application.

B. Switches: Airflow switches shall be installed where indicated to detect airflow or absence of airflow in ducts. Switch shall be single pole double throw activated by stainless steel paddle. For ducts less than 50 square inches, switch shall close on a minimum velocity of 100 fpm horizontal air flow and 350 fpm vertical. For ducts greater than 50 square inches, switch shall close on a minimum velocity of 250 fpm horizontal air flow and 650 fpm vertical.

2.4 ACCESSORIES

A. Wiring and conduit:
   1. Comply with requirement of Division 16.
   2. Control wiring:
      a. Include low voltage wiring (100 volts and less) required for temperature control systems under this section.
      b. Include power wiring required for a complete temperature control system not indicated in electrical plans and specifications.
   3. Conductors for control signals: No.18 or 19 AWG copper conductors as required.
      a. Connectors may be assembled in cable with PVC insulation minimum of 0.016 IN thick.
      b. Cable outer sheeting standard with manufacturer.
      c. Line voltage wire for temperature control shall comply with Division 26 of the specifications.
   4. Provide conduit for control wiring.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Connect control devices including devices provided in related sections to perform functions indicated and perform in required sequence.

B. Run control wiring in separate conduit from power wiring, except control wiring from starters may be run in same conduit as power wiring.

3.2 PROGRAMMING:
A. General: Controllers shall be programmed to provide the indicated sequences of operation. Selection of control mode (P, PI, or PID) shall be based upon the specific devices involved such that the process variables are restored and maintained at the desired level without offset in a responsive and stable manner. Programs shall be written in such a manner that all systems and equipment will default to a safe operation or position in the event of a hardware, communication, or software failure.

3.3 TESTING:

A. When the installation of the system is complete, the Contractor shall execute the following field tests:
1. Calibrate all temperature sensors.
2. Verify proper operation of each control point.

3.4 TRAINING:

A. Contractor shall fully instruct the Owner’s maintenance personnel in the proper operation and maintenance of the installed equipment and systems. Training shall be provided in a classroom format with written literature for up to five (5) participants. Training times shall be scheduled in advance with the Owner. Training shall address as a minimum the following topics: control diagrams, catalog data, and maintenance manuals, walk-through of project to inspect control components, thorough review of controller functions, and explanation of scheduled maintenance requirements including adjustment, calibration, and replacement procedure. Instructor training shall be a minimum of 4 hours in duration.

PART 4 - SEQUENCE OF OPERATION

4.1 Refer to the drawings for the Sequence of Operation

END OF SECTION
PART 1 - GENERAL

1.1. WORK INCLUDES

A. Contractor test, balance and adjust air distribution systems and air moving equipment.

1.2. DEFINITIONS

A. Adjust: To regulate fluid flow rate and air patterns at the terminal equipment, such as to reduce fan speed or adjust a damper.

B. Balance: To proportion flows within the distribution system, including submains, branches, and terminals, according to design quantities.

C. Procedure: An approach to and execution of a sequence of work operations to yield repeatable results.

D. Report Forms: Test data sheets for recording test data in logical order.

E. System Effect: A phenomenon that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.

F. System Effect Factors: Allowances used to calculate a reduction of the performance ratings of a fan when installed under conditions different from those presented when the fan was performance tested.

G. Terminal: A point where the controlled medium, such as fluid or energy, enters or leaves the distribution system.

H. Test: A procedure to determine quantitative performance of a system or equipment.

I. Testing, Adjusting, and Balancing Agent: The entity responsible for performing and reporting the testing, adjusting, and balancing procedures.


M. SMACNA: Sheet Metal and Air Conditioning Contractors’ National Association.

1.3. QUALITY ASSURANCE
A. Agency qualifications: Independent balance and testing agency, member of Associated Air Balance Council (AABC), National Environmental Balancing Bureau (NEBB), or Testing and Balancing Bureau (TABB).
   1. Work supervised by registered mechanical engineer.
   2. Show at least 5 successfully completed projects of similar size and scope.

B. Balancing standards: Associated Air Balance Council requirements and recommendations.

1.4. RESPONSIBILITIES OF TESTING AND BALANCING AGENCY WORK

A. Schedule work with trades involved.

B. Check, adjust, and balance system components to obtain optimum conditions for function and operation of system.

C. Evaluate operation of systems and advise installer of necessary adjustments and corrective measures.

D. Prepare and submit test reports.

1.5. RESPONSIBILITIES OF MECHANICAL WORK

A. Startup system and keep in correct operation during balancing operations.

B. Make accessible, personnel to provide necessary adjustments and corrections to systems as directed by balancing agency.

C. Maintain accessibility to test locations and devices requiring adjustment.

D. Add dampers required for correct air balance as recommended by Air Balance Agency.

1.6. SUBMITTALS (See Division 1)

A. Shop drawings: Not required for Engineer/Architect review.

B. Product data: Not required for Engineer/Architect review.

C. Samples: Not required for Engineer/Architect review.

D. Project information:
   1. Qualifications of balancing agency and sample report forms.

E. Contract closeout information:
   1. Balancing reports: Include specified data.
      a. Use forms similar to AABC latest edition.
   2. Guarantee.
1.7. COORDINATION

A. Coordinate the efforts of factory-authorized service representatives for systems and equipment, HVAC controls installers, and other mechanics to operate HVAC systems and equipment to support and assist testing, adjusting, and balancing activities.

B. Notice: Provide 7 days’ advance notice for each test. Include scheduled test dates and times.

1.8. WARRANTY

A. Provide extended warranty of 90 days, after completion of test and balance work, during which time Owner may at his discretion, request recheck or resetting of equipment or system which is not performing satisfactorily.

B. Provide technicians to assist as required in making such tests.

PART 2 - PRODUCTS

2.1 PATCHING MATERIALS

A. Except as otherwise indicated, use same products as used by original Installer for patching holes in insulation ductwork and housings which have been cut or drilled for test purposes, including access for test instruments, attaching jigs, and similar purposes.

B. Rubber plugs with retainers shall be used to patch drilled holes in ductwork and housings.

C. Do not leave test holes uncovered.

PART 3 - EXECUTION

3.1 GENERAL

A. Accurately calibrate and maintain test instruments in good working order.
   1. If requested, conduct tests of instruments in presence of Owner.

B. If requested, conduct balancing tests in presence of Owner.

C. Do not begin balancing until system(s) have been completed and are in good working order.

D. Record inspections, tests and adjustments.

3.2 AIR BALANCING METHODS

A. Balance each air system that is served by air filters, using artificial static loading of system, to demonstrate, test and obtain system design pressure drop data.
   1. Provide dirty filter pressure drop conditions on system.
   2. Do not use high efficiency filters (75 percent and above) in testing and balancing.
   3. Static pressure losses may be simulated by using wood or sheet steel blanking plates in high efficiency filter racks and housings.
   4. Do not install blanking plates within 2 FT of low efficiency filter unit or rack.
3.3 AIR BALANCE TESTING PROCEDURE

A. Perform tests and balance system in accordance with following:

B. Test and adjust equipment capacity to design requirements and record speed (RPM).

C. Test motor load amperes and fan rotation.

D. Make pitot tube traverse of main supply ducts and obtain design airflow (CFM) at fans.

E. Test system static pressures, suction and discharge.

F. Test and adjust system for design airflow (CFM) outside and return air:

G. Test coil entering air temperatures:
   1. Dry bulb deg. F heating and cooling.
   2. Wet bulb deg. F cooling.

H. Test leaving air temperatures:
   1. Dry bulb deg. F heating and cooling.
   2. Wet bulb deg. F cooling.

I. Adjust zones to proper design airflow (CFM), supply and return.

J. Test and adjust each diffuser, grille, and register to within 10 percent of design requirements.
   1. Identify location and area of each grille, diffuser, and register.
   2. Identify and list size, type and manufacture of diffusers, grilles, registers.
   3. Use manufacturer’s ratings on equipment to make required calculations.
   4. Readings and tests of diffusers, grilles, and registers shall include required velocity (FPM)
      and test resultant velocity, required airflow (CFM) and test resultant airflow (CFM) after
      adjustments.
   5. Adjust diffusers, grilles, and registers to minimize drafts.

K. In cooperation with unit manufacturer’s representative, check controls for proper calibration and
   list controls requiring adjustment by unit manufacturer’s representative.

L. Balance supply, return, and exhaust air to provide designed pressure relationships to adjacent
   areas.

M. Make changes on fan speeds and/or damper settings to achieve capacity.

3.4 OPERATING TEST

After systems are balanced, conduct operating test of not less than 8 hours duration each for
heating and cooling systems to demonstrate to satisfaction of Owner that systems comply with
requirements of plans and specifications, and that equipment and controls are functioning properly.

END OF SECTION
SECTION 16000
GENERAL ELECTRICAL

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor, materials and equipment required to install complete and make operational, electrical and process instrumentation systems as specified, as shown on the Drawings.

B. The work shall include furnishing and installing the following:

1. Electrical service from the existing electrical equipment rack and modifications as required.

2. Conduit, wire and field connections for all motors, motor controllers, control devices, control panels, electrical equipment and instrumentation devices furnished under other Divisions of these Specifications.

3. Conduit, wiring and terminations for all field-mounted instruments furnished and mounted under other Divisions of these Specifications, including process instrumentation primary elements, transmitters, local indicators and control panels. Lightning and surge protection equipment wiring at process instrumentation transmitters. Install vendor furnished cables specified under other Divisions of these Specifications.

4. Power wiring for all heating, ventilating, and air conditioning equipment furnished under other Divisions of these Specifications. Electrical contractor shall coordinate with the mechanical contractors and provide conduit and wiring as required.

5. Telephone service from the Telephone Company.

6. Fire Alarm and Detection System

7. Security System

8. Grounding System

9. Underground System

10. Lighting system, fixtures and devices

11. Panelboards, transformers and electrical devices described in Division 16.

12. Coordination work with motor control centers provided by (ITT.)

13. Lightning Protection System

14. Instrumentation and SCADA System equipment provided by others
15. Surge protection equipment as required.

16. Short circuit, coordination, and arc flash studies in accordance with Section 16035. Infrared testing shall also be in accordance with Section 16035.

C. Each bidder or their authorized representatives shall, before preparing their proposal, visit all areas of the existing buildings and structures in which work under this bid is to be performed and inspect carefully the present installation. The submission of the proposal by this bidder shall be considered evidence that they have visited the site, buildings and structures and noted the locations and conditions under which the work will be performed and that they take full responsibility for a complete knowledge of all factors governing his/her work.

D. Excavation, bedding material, forms, concrete and backfill for underground raceways; forms and concrete for electrical equipment furnished under Division 16. The work shall be in accordance with Divisions 2 and 3.

1.02 RELATED WORK

A. Excavation and backfilling, including gravel or sand bedding for underground electrical work is described in Division 2.

B. Cast in place concrete work, including concrete encasements for electrical duct banks, equipment pads, lighting pole bases and reinforcing steel, is described in Division 3.

C. Except for directly controlled, single phase, unit heater thermostat wiring and all interlocking and termination wiring within the motor starter/motor control centers, all automatic temperature control wiring for heating, ventilating and air conditioning equipment (thermostats, duct switches, P-E switches, dampers, automatic temperature control panels, etc) will be furnished and installed under Division 15, unless otherwise indicated on the Drawings.

D. Refer to the Architectural floor plans for room and building dimensions.

E. Refer to HVAC and Process Mechanical Drawings for the exact location of mechanical, instrumentation and process equipment.

F. Include all auxiliaries and accessories for a complete and properly operating system.

G. Provide and install all electrical systems and any necessary accessories as per NEC and local codes whether specified herein or shown on drawings or not. The content of these specifications (Division 16) and contract documents in general only refers to work required above and beyond the requirements of the NEC and applicable local codes.

1.03 SUBMITTALS

A. Submit shop drawings for equipment, materials and other items furnished under Division 16. Submittals shall be in accordance with Section 01330 and the following requirements.

B. Check shop drawings for accuracy and contract requirements prior to submittal. Shop drawings shall be stamped with the date checked and a statement indicating that the shop drawings conform to Specifications and Drawings. This statement shall also list all
exceptions to the Specifications and Drawings. Shop drawings not so checked and noted shall be returned.

C. The Engineer's check shall be for conformance with the design concept of the project and compliance with the Specifications and Drawings. Errors and omissions on approved shop drawings shall not relieve the Contractor from the responsibility of providing materials and workmanship required by the Specifications and Drawings.

D. All dimensions shall be field verified at the job site and coordinated with the work of all other trades.

E. Material shall not be ordered or shipped until the shop drawings have been approved. No material shall be ordered or shop work started if shop drawings are “REJECTED.”

F. Operation and Maintenance Data

1. Submit operations and maintenance data for equipment furnished under this Division, as specified in Section 01830. The manuals shall be prepared specifically for this installation and shall include catalog data sheets, drawings, equipment lists, descriptions, parts lists, etc, to instruct operating and maintenance personnel unfamiliar with such equipment.

1.04 CONTRACT PERFORMANCE REQUIREMENTS

A. Electric equipment, materials and installation shall comply with the latest edition of the National Electrical Code (NEC) and with the latest edition of the following codes and standards:

1. National Electrical Safety Code (NESC)

2. Occupational Safety and Health Administration (OSHA)

3. National Fire Protection Association (NFPA)

4. National Electrical Manufacturers Association (NEMA)

5. American National Standards Institute (ANSI)

6. Insulated Cable Engineers Association (ICEA)

7. Instrument Society of America (ISA)

8. Underwriters Laboratories (UL)

9. Factory Mutual (FM)

10. National Electrical Testing Association (NETA)

B. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

1.05 PRIORITY OF THE CONTRACT DOCUMENTS
A. If, during the performance of the work, the Contractor finds a conflict, error or discrepancy between or among one or more of the Sections or between or among one or more Sections and the Drawings, furnish the higher performance requirements. The higher performance requirement shall be considered the equipment, material, device or installation method which represents the most stringent option, the highest quality or the largest quantity.

B. In all cases, figured dimensions shall govern over scaled dimensions, but work not dimensioned shall be as directed by the Engineer and work not particularly shown, identified, sized, or located shall be the same as similar work that is shown or specified.

C. Detailed Drawings shall govern over general drawings, larger scale Drawings take precedence over smaller scale Drawings, Change Order Drawings shall govern over Contract Drawings and Contract Drawings shall govern over Shop Drawings.

D. If the issue of priority is due to a conflict or discrepancy between the provisions of the Contract Documents and any referenced standard, or code of any technical society, organization or association, the provisions of the Contract Documents will take precedence if they are more stringent or presumptively cause a higher level of performance. If there is any conflict or discrepancy between standard specifications, or codes of any technical society, organization or association, or between Laws and Regulations, the higher performance requirement shall be binding on the Contractor, unless otherwise directed by the Engineer.

E. In accordance with the intent of the Contract Documents, the Contractor accepts the fact that compliance with the priority order specified shall not justify an increase in Contract Price or an extension in Contract Time nor limit in any way, the Contractor's responsibility to comply with all Laws and Regulations at all times.

1.06 ENCLOSURE TYPES

A. Unless otherwise specified electrical enclosures shall have the following ratings:

1. NEMA 1 for dry, non-process indoor above grade locations.

2. NEMA 3R for outdoor non-corrosive or hazardous areas.

3. NEMA 12 for indoor dust producing areas.

4. NEMA 4X for all outdoor locations.

1.07 CODES, INSPECTION AND FEES

A. Equipment, materials and installation shall comply with the requirements of the local authority having jurisdiction.

B. Obtain all necessary permits and pay all fees required for permits and inspections.

1.08 TESTS AND SETTINGS

A. Test systems and equipment furnished under Division 16 and repair or replace all defective work and equipment. Refer to the individual equipment sections for additional specific testing requirements. Testing shall be in accordance with Section 01750 and the following requirements.
B. Make adjustments to the systems and instruct the Owner's personnel in the proper operation of the systems.

C. In addition to the specific testing requirements listed in the individual sections, the following minimum tests and settings shall be performed.

1. Mechanical inspection, testing and settings of circuit breakers, disconnect switches, protection relays, motor starters, overload relays, control circuits and equipment for proper operation.

2. Check the full load current draw of each motor. Where power factor correction capacitors are provided the capacitor shall be in the circuit at the time of the measurement. Check ampere rating of thermal overloads for motors and submit a typed record to the Engineer of the same, including MCC cubicle location and driven load designation, motor service factor, horsepower, and Code letter. If incorrect thermal overloads are installed replace same with the correct size overload.

3. Check power and control power fuse ratings. Replace fuses if they are found to be of the incorrect size.

4. Check settings of the motor circuit protectors. Adjust settings to lowest setting that will allow the motor to be started when under load conditions.

5. Check motor nameplates for correct phase and voltage. Check bearings for proper lubrication.

6. Check rotation of motors prior to testing the driven load. Disconnect the driven equipment if damage could occur due to wrong rotation. If the rotation is for the driven equipment is not correct, disconnect the motor lead connections at the motor terminal box and reconnect for proper rotation.

7. Check interlocking, control and instrument wiring for each system and/or part of a system to prove that the system will function properly as indicated by control schematic and wiring diagrams.

8. Verify all terminations at transformers, equipment, panels and enclosures by producing a 1, 2, 3 rotation on a phase sequenced motor when connected to "A," "B" and "C" phases.

9. Test the grounding system using the three point fall in potential method.

10. Test all 600 Volt wire insulation with a meg-ohm meter after installation. Make tests at not less than 500V. Submit a written test report of the results to the Engineer.

11. Assist in the testing of the standby generator and automatic transfer switch. A licensed electrician shall be standing throughout the test perform make adjustments to or test the equipment furnished under this Division of the specifications and to open electrical enclosures.

D. Testing shall be scheduled and coordinated with the Owner and Engineer at least two weeks in advance. Provide qualified test personnel, instruments and test equipment.

1.09 SIZE OF EQUIPMENT
A. Investigate each space in the structure through which equipment must pass to reach its final location. Coordinate shipping splits with the manufacturer to permit safe handling and passage through restricted areas in the structure.

B. The equipment shall be kept upright at all times during storage and handling. When equipment must be tilted for passage through restricted areas, brace the equipment to insure that the tilting does not impair the functional integrity of the equipment.

1.10 RECORD DRAWINGS

A. As the work progresses, legibly record all field changes on a set of project contract drawings, hereinafter called the "record drawings."

B. Record drawings shall accurately show the installed condition of the following items:
   1. One-line Diagram(s).
   2. Raceways and pullboxes.
   3. Conductor sizes and conduit fills.
   4. Panel Schedule(s).
   5. Control Wiring Diagram(s).
   6. Lighting Fixture Schedule(s).
   7. Lighting fixture, receptacle and switch outlet locations.
   8. Underground raceway and duct bank routing.
   9. Plan view, sizes and locations of switchgear, distribution transformers, motor control centers and panelboards.

C. The Contractor shall submit as-built information including certified survey drawings and digital files. Refer to Sections 01541 and 01781 for additional information and requirements.

D. Submit a schedule of control wiring raceways and wire numbers, including the following information:
   1. Circuit origin, destination and wire numbers.
   2. Field wiring terminal strip names and numbers.

E. As an alternate, point-to-point connection diagrams showing the same information may be submitted in place of the schedule of control wiring raceways and wire numbers.

F. Submit the record drawings and the schedule of control wiring raceways and wire numbers (or the point-to-point connection diagram) to the Engineer.

1.11 EQUIPMENT INTERCONNECTIONS
A. Review shop drawings of equipment furnished under other Divisions of this Specification and prepare coordinated wiring interconnection diagrams or wiring tables. Submit copies of wiring diagrams or tables with Record Drawings.

B. Furnish and install all equipment interconnections.

1.12 MATERIALS AND EQUIPMENT

A. Materials and equipment shall be new.

B. Material and equipment of the same type shall be the product of one manufacturer and shall be UL listed.

C. Warrant all equipment furnished under Division 16 in accordance with contract documents. Refer to individual equipment sections for additional warranty items.

1.13 EQUIPMENT IDENTIFICATION

A. Identify equipment (disconnect switches, separately mounted motor starters, control stations, etc) furnished under Division 16 with the name of the equipment it serves. Motor control centers, control panels, panelboards, switchboards, switchgear, junction or terminal boxes, transfer switches, etc, shall have nameplate designations as shown on the Drawings.

B. Nameplates shall be engraved, laminated plastic, not less than 1/16-in thick by 3/4-in by 2-1/2-in with 3/16-in high black letters on a white background.

C. Nameplates shall be screw mounted to NEMA 1 enclosures. Nameplates shall be bonded to all other enclosure types using an epoxy or similar permanent waterproof adhesive. Two sided foam adhesive tape is not acceptable. Where the equipment size does not have space for mounting a nameplate the nameplate shall be permanently fastened to the adjacent mounting surface.

D. Refer to Section 01600 for additional requirements, which might be more stringent.

1.14 INTERPRETATION OF DRAWINGS

A. Unless specifically stated to the contrary, the Drawings are not intended to show exact locations of conduit runs. Coordinate the conduit installation with other trades and the actual supplied equipment.

B. Drawings are diagrammatic. Correlate final equipment locations with governing Architectural, Structural, Process Mechanical and Instrumentation and Control drawings. Lay out before installation so that all trades may install equipment in spaces available. Provide coordination as required for installation in a neat and workmanlike manner. The Engineer reserves the right to move any device 10' from locations shown on plans with no additional costs to the Owner at any time prior to final equipment installation and startup. Provide layout shop drawings for Engineer’s review for all MCC and electrical equipment rooms.

C. Install each 3 phase circuit in a separate conduit unless otherwise shown on the Drawings.
D. Unless otherwise approved by the Engineer, conduit shown exposed shall be installed exposed; conduit shown concealed shall be installed concealed.

E. Where circuits are shown as "home-runs" all necessary fittings and boxes shall be provided for a complete raceway installation. Where home-runs indicate conduit is to be installed concealed or exposed the entire branch circuit shall be installed in the same manner. Unless otherwise indicated install branch circuit conduits exposed in process/industrial type spaces and concealed in finished spaces.

F. Verify the exact locations and mounting heights of lighting fixtures, switches and receptacles prior to installation.

G. Except where dimensions are shown, the locations of equipment, fixtures, outlets and similar devices shown on the Drawings are approximate only. Exact locations shall be determined by the Contractor and approved by the Engineer during construction. Obtain information relevant to the placing of electrical work and in case of any interference with other work, proceed as directed by the Engineer and furnish all labor and materials necessary to complete the work in an approved manner.

H. Circuit layouts are not intended to show the number of fittings, or other installation details. Furnish all labor and materials necessary to install and place in satisfactory operation all power, lighting and other electrical systems shown.

I. Redesign of electrical or mechanical work, which is required due to the Contractor’s use of an alternate item, arrangement of equipment and/or layout other than specified herein, shall be done by the Contractor at his/her own expense. Redesign and detailed plans shall be submitted to the Engineer for approval. No additional compensation will be provided for changes in the work, either his/her own or others, caused by such redesign.

J. Raceways and conductors for low voltage (120 Volts) thermostats controlling HVAC unit heaters, exhaust fans and similar equipment are not shown on the Drawings. Provide raceways and conductors between the thermostats, the HVAC equipment and the motor starters for a complete and operating system. Raceways shall be installed concealed in all finished space and may be installed concealed or exposed in process spaces. Refer to the HVAC drawings for the locations of the thermostats.

K. Raceways and conductors for the fire alarm system are not shown on the Drawings. Provide raceways and conductors as required by the system manufacturer for a complete and operating system. Raceways shall be installed concealed in all finished spaces and may be installed exposed or conducted in process spaces.

L. It is the intent of these Specifications that the Electrical Systems shall be suitable in every way for the service required. All materials and all work that may be implied as being incidental to the work of this Section shall be furnished at no additional cost to the Owner.

M. Raceways and conductors for lighting, switches, receptacles and other miscellaneous low voltage power and signal systems as specified are not shown on the Drawings. Raceways and conductors shall be provided as required for a complete and operating system. Homeruns, as shown on the Drawings, are to assist the Contractor in identifying raceways to be run exposed and raceways to be run concealed. Raceways shall be installed concealed in all finished spaces and may be installed exposed or concealed in all process spaces. Raceways installed exposed shall be near the ceiling.
or along walls of the areas through which they pass and shall be routed to avoid conflicts with HVAC ducts, cranes hoists, monorails, equipment hatches, doors, windows, etc. Raceways installed concealed shall be run in the center of concrete floor slabs, above suspended ceilings, or in partitions as required.

N. Provide separate neutral conductors for each lighting branch circuit and outlet branch circuits. Common neutrals are not allowed.

1.15 QUALIFICATIONS OF THE CONTRACTOR

A. The Electrical Contractor shall be regularly engaged in the construction, maintenance repair and modification of industrial plant electrical equipment devices and systems. The lead, on-site, technical person shall be approved by the Engineer. Provide the services of a pre-qualified electrical contractor that has demonstrated competence in providing electrical systems installation on this type of facility to Collier County Utilities; The pre-approved electrical contractors for this project are listed below:

1. American Electric
2. Cogburn Electrical
3. Gulf States Electrical
4. Southern Power and Controls

Other firms will be considered by the Engineer on submittal of qualifications on or before 14 days prior to bid. Submit 10 example projects of installed history of the type and complexity of this project. Submit project data, and reference contacts.

B. SUPERVISION OF THE WORK: Provide a field superintendent who has had a minimum of fifteen (15) years previous successful experience on projects of comparable size and complexity. Superintendent shall be present at all times that work under this Division is being installed or affected. Superintendent shall have passed a proctored H.H. Block Masters Exam with 75% grade or better and shall hold a State Masters Certificate of Competency. A resume of the Superintendent’s experience shall be submitted to Engineer before starting work. The resume shall list a minimum of 10 previous industrial plant projects of comparable size and complexity.

1.16 COORDINATION

A. Provide all required coordination and supervision where work connects to or is affected by work of others, and comply with all requirements affecting this Division. Work required under other divisions, specifications or drawings, indicated 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 roll-up doors, control panel installation, instrumentation and control installation, etc.

B. Locate all openings required for work performed under this section. Provide sleeves, guards or other approved methods to allow passage of items installed under this section.

1.17 BASIS FOR WIRING DESIGN

A. The drawings and specifications 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.). Wherever the contractor provides power consuming
equipment which differs from the basis of design, drawings and specifications, the wiring and associated circuit components for such equipment shall be changed to proper sizes to match at no additional expense to the Owner.

1.18 PROVISIONS FOR OPENINGS

A. Locate all openings required for work performed under this section. Provide sleeves, guards or other approved methods to allow passage of items installed under this section.

B. Furnish to roofer all pitch pans required for electrical items which pierce roof whether or not shown on drawings. Roof penetrations are to be waterproofed in such a manner that roofing guarantees are fully in force.

1.19 CONCRETE PADS

A. Furnish and install reinforced concrete pads for transformers, switchgear, and motor control centers, of size as shown on the drawing or required. Unless otherwise noted, pads shall be four (4) inches high and shall exceed dimensions of equipment being set on them, including future sections, by three (3) inches on all sides, except when equipment is flush against a wall, then the side or sides against the wall shall be flush with the equipment. Chamfer top edges 1”. Trowel all surfaces smooth.

PART 2 - PRODUCTS

2.01 MISCELLANEOUS EQUIPMENT

A. Circuit Breakers

1. Provide thermal magnetic circuit breaker in NEMA Type 4X Enclosure with externally operated handle. Circuit breakers shall be fully rated for 65,000 Amps RMS symmetrical.

2. Circuit breakers shall be manufactured by Square D Co.; General Electric Company; or equal.

B. Control Stations

1. Control stations shall be heavy-duty type, with full size operators. Momentary contact stop buttons shall have a lockout latch that can be padlocked in the open position.

2. NEMA 4X enclosures shall be stainless steel.

3. Control stations shall be Square D Class 9001; Cutler Hammer Co.; General Electric Company; Allen Bradley Company or equal.

C. Polyethylene Warning Tape

1. Warning tape shall be red polyethylene film, 6-in minimum width.

2. Warning tape shall be W.H. Brady Co., Catalog No. 91296 or equal. Tape shall have printed text in English, “Electrical Service Buried Below” or similar wording.
2.03 TELEPHONE SYSTEM

A. Make all necessary arrangements with Telephone Companies for any participation that may be necessary and furnish all labor and material that may be required and pay all charges the telephone companies may have for their service.

2.04 GROUNDING

A. Ground rods shall be 3/4-in by 10-ft copper clad steel and constructed in accordance with UL 467. The minimum copper thickness shall be 0.25 mm. Ground rods shall be Copperweld or equal.

B. Grounding conduit hubs shall be malleable iron type similar to Thomas & Betts Co.; Cat No. 3940 (3/4-in conduit size) by Burndy; O.Z./Gedney Co. or equal, and of the correct size for the conduit.

C. Buried grounding connections shall be by Cadweld process, or equal exothermic welding system.

PART 3 - EXECUTION

3.01 SLEEVES AND FORMS FOR OPENINGS

A. Provide and place all sleeves for conduits penetrating floors, walls, partitions, etc. Locate all necessary slots for electrical work and form before concrete is poured.

B. Exact locations are required for stubbing-up and terminating concealed conduit. Obtain shop drawings and templates from equipment vendors or other subcontractors and locate the concealed conduit before the floor slab is poured.

C. Where setting drawings are not available in time to avoid delay in scheduled floor slab pours, the Engineer may allow the installations of such conduit to be exposed. Requests for this deviation must be submitted in writing. No additional compensation for such change will be allowed.

D. Seal all openings, sleeves, penetration and slots.

3.02 CUTTING AND PATCHING

A. Cutting and patching shall be done in a thoroughly workmanlike manner and be in compliance with modifications and repair to concrete as required. Sawcut concrete and masonry prior to breaking out sections.

B. Core drill holes in concrete floors and walls as required.

C. Install work at such time as to require the minimum amount of cutting and patching.

D. Do not cut joists, beams, girders, columns or any other structural members.

E. Cut opening only large enough to allow easy installation of the conduit.

F. Patching to be of the same kind and quality of material as was removed.
G. The completed patching work shall restore the surface to its original appearance or better.

H. Patching of waterproofed surfaces shall render the area of the patching completely waterproofed.

I. Remove rubble and excess patching materials from the premises.

J. When existing conduits are cut at the floor line of wall line, they shall be filled with grout of suitable patching material.

3.03 INSTALLATION

A. Any work not installed according to the Specifications shall be subject to change as directed by the Engineer. No extra compensation will be allowed for making these changes.

B. Electrical equipment shall be protected at all times against mechanical injury or damage by water. Electrical equipment shall not be stored outdoors. Electrical equipment shall be stored in dry permanent shelters. Do not install electrical equipment in its permanent location until structures are weather-tight. If any apparatus has been subject to possible injury by water, it shall be thoroughly dried out and tested as directed by the Engineer, or shall be replaced at no additional cost at the Engineer's discretion.

C. Equipment that has been damaged shall be replaced or repaired by the equipment manufacturer, at the Engineer's discretion.

D. Repaint any damage to factory applied paint finish using touch-up paint furnished by the equipment manufacturer. The entire damaged panel or section shall be repainted per the field painting specifications, at no additional cost to the Owner.

E. Coordinate the conduit installation with other trades and the actual supplied equipment.

F. Install each 3 phase circuit in separate conduit.

G. Unless otherwise approved by the Engineer, conduit installed interior to the building shall be installed exposed; conduit installed exterior to the building shall be concealed.

H. Verify the exact locations and mounting heights of lighting fixtures, switches and receptacles prior to installation.

I. Exact locations of electrical equipment shall be determined by the Contractor and approved by the Engineer during construction. Obtain information relevant to the placing of electrical work and in case of any interference with other work, proceed as directed by the Engineer and furnish all labor and materials necessary to complete the work in an approved manner.

3.04 BOXES AND FITTINGS

A. Except where otherwise specified, all wiring shall be in rigid steel conduit, PVC schedule 40 or EMT as specified in areas or for specific systems.

B. Rigid steel conduit shall be used at all locations as raceways for shielded process instrumentation wiring, shielded control wiring, and I/O wiring.
C. PVC conduit shall be used for concrete encased underground duct banks.

D. Aluminum conduit shall be used for exposed conduit runs outdoors, in areas designated as "WET."

E. All boxes shall be metal.

F. Exposed switch, receptacle and lighting outlet boxes and condulet fittings shall be cast or malleable iron, except that cast aluminum shall be used with aluminum conduit.

G. Concealed switch, receptacle and lighting outlet boxes shall be pressed steel.

H. Terminal boxes, junction boxes and pull boxes shall have NEMA ratings suitable for the location in which they are installed.

I. Conduit wall seals shall be used where underground conduits penetrate walls.

J. Conduit sealing bushings shall be used to seal conduit ends exposed to the weather.

K. The ends of all conduits shall be tightly plugged to exclude dust and moisture during construction.

L. Conduit supports, other than for underground raceways, shall be spaced at intervals of 8-ft or less.

M. Conduit hangers shall be attached to structural steel by means of beam or channel clamps. Where attached to concrete surfaces, concrete inserts of the spot type shall be provided.

N. All conduits shall be run at right angles to and parallel with the surrounding wall and shall conform to the form of the ceiling. No diagonal runs will be allowed. Bends in parallel conduit runs shall be concentric. All conduits shall be run perfectly straight and true.

O. Conduit terminating in pressed steel boxes shall have double locknuts and insulated bushings.

P. Conduit terminating in NEMA 3R, 4, 4X and 12 enclosures shall be terminated with Myers type conduit hubs.

Q. Conduits containing equipment grounding conductors and terminating in sheet steel boxes shall have insulated throat grounding bushings.

R. Conduits shall be installed using threaded fittings.

S. Liquidtight flexible metal conduit shall be used for all motor terminations, the primary and secondary of transformers, generator terminations and other equipment where vibration is present.

T. Flexible couplings shall be used in hazardous locations for all motor terminations and other equipment where vibration is present.
U. Aluminum fittings and boxes shall be used with aluminum conduit. Aluminum conduit shall not be imbedded in concrete. Aluminum conduit shall be isolated from other metals with plastic sleeves or plastic-coated hangers. Strap wrenches shall be used for tightening aluminum conduit.

V. Where conduits pass through openings in walls or floor slabs, the remaining openings shall be sealed against the passage of flame and smoke.

W. PVC conduit to non-metallic box connections shall be made with PVC socket to male thread terminal adapters with neoprene O-ring and PVC round edge bushings.

X. Conduit ends exposed to the weather shall be sealed with conduit sealing bushings.

Y. PVC conduit shall be supported with non-metallic clamps, racks and stainless steel hardware.

Z. PVC boxes, conduit fittings, etc with integral hubs shall be solvent welded directly to the PVC conduit system.

AA. Non-metallic boxes with field drilled or punched holes shall be connected to the PVC conduit system with threaded and gasketed PVC Terminal Adapters.

BB. All conduit entering or leaving a motor control center, switchboard or other multiple compartment enclosure shall be stubbed up into the bottom horizontal wireway or other manufacturer designated area, directly below the vertical section in which the conductors are to be terminated.

CC. All conduit which may under any circumstance contain liquids such as water, condensation, liquid chemicals, etc, shall be arranged to drain away from the equipment served. If conduit drainage is not possible, conduit seals shall be used to plug the conduits.

DD. Where no type or size is indicated for junction boxes, pull boxes or terminal cabinets, they shall be sized in accordance with the requirements of N.E.C. Article 370.

EE. Miscellaneous steel for the support of fixtures, boxes, transformers, starters, contactors, panels and conduit shall be furnished and installed.

FF. Steel channels, flat iron and channel iron shall be furnished and installed for the support of all electrical equipment and devices, where required, including all anchors, inserts, bolts, nuts, washers, etc for a rigid installation. All interior support devices shall be hot dipped galvanized after fabrication. All exterior support devices shall be fabricated from Type 304 stainless steel. All anchors, fasteners and appurtenances shall be Type 316 stainless steel.

GG. Conduits passing from heated to unheated spaces, exterior spaces, refrigerated spaces, cold air plenums, etc, shall be sealed with "Duxseal" as manufactured by Manville or seal fitting to prevent the accumulation of condensation.

HH. Rigid galvanized steel conduits which have been field cut and threaded shall be painted with cold galvanizing compounds.

II. Conduit expansion and deflection fittings shall be installed on all conduits crossing building expansion joint. Where conduits are installed outdoors provide expansion and...
3.05 WIRE, CABLE AND ACCESSORIES

A. Uniquely identify all wires, cables and each conductor of multi-conductor cables (except lighting and receptacle wiring) at each end with wire and cable markers.

B. Use lubrications to facilitate wire pulling. Lubricants shall be UL approved for use with the insulation specified.

C. All wire shall be color coded or coded using electrical tape in sizes where colored insulation is not available. Where tape is used as the identification system, it shall be applied in all junction boxes, and other accessible intermediate locations as well as at each termination.

D. The following coding shall be used:

<table>
<thead>
<tr>
<th>System</th>
<th>Wire</th>
<th>Color</th>
</tr>
</thead>
<tbody>
<tr>
<td>208Y/120, Volts</td>
<td>Neutral</td>
<td>White</td>
</tr>
<tr>
<td>3-Phase, 4-Wire</td>
<td>Phase A</td>
<td>Black</td>
</tr>
<tr>
<td></td>
<td>Phase B</td>
<td>Red</td>
</tr>
<tr>
<td></td>
<td>Phase C</td>
<td>Blue</td>
</tr>
<tr>
<td>480Y/277 Volts</td>
<td>Neutral</td>
<td>White</td>
</tr>
<tr>
<td>3-Phase, 4-Wire</td>
<td>Phase A</td>
<td>Brown</td>
</tr>
<tr>
<td></td>
<td>Phase B</td>
<td>Orange</td>
</tr>
<tr>
<td></td>
<td>Phase C</td>
<td>Yellow</td>
</tr>
</tbody>
</table>

E. Power conductors: Terminations shall be die type or set screw type pressure connectors as specified. Splices (only where specifically allowed by the Engineer) shall be die type compression connector and waterproof with heat shrink boot or epoxy filling. Aluminum conductors (where specified) shall employ terminations and splices specifically designed for aluminum conductors.

F. Control Conductors: Termination on saddle-type terminals shall be wired directly with a maximum of two conductors. Termination on screw type terminals shall be made with a maximum of two spade connectors. Splices (where allowed) shall be made with insulated compression type connectors.

G. Instrumentation Signal Conductors (including graphic panel, alarm, low and high level signals): terminations same as for control conductors. Splices allowed at instrumentation terminal boxes only.

H. Except where permitted by the Engineer no splices will be allowed in manholes, handholes or other below grade located boxes.

I. Splices shall not be made in push button control stations, control devices (i.e., pressure switches, flow switches, etc), conduit bodies, etc.

J. Instrumentation cables shall be installed in rigid steel raceways as specified. All circuits shall be installed as twisted pairs or triads. In no case shall a circuit be made up using conductors from different pairs or triads. Triads shall be used wherever three wire circuits are required.
K. Terminal blocks shall be provided at all instrument cable junction and all circuits shall be identified at such junctions.

L. Shielded instrumentation wire, shall be run without splices between instruments, terminal boxes, or panels.

M. Shields shall be grounded as recommended by the instrument manufacturer and isolated at all other locations. Terminal blocks shall be provided for inter-connecting shield drain wires at all junction boxes. Where individual circuit shielding is required, each shield circuit shall be provided with its own block.

3.06 WIRING DEVICES

A. Switch and receptacles outlets shall be installed flush with the finished wall surfaces in areas with stud frame and gypboard construction, in dry areas with cement block construction or when raceways are concealed.

B. Do not install flush mounted devices in areas designated DAMP, WET or WET/CORROSIVE. Provide surface mounted devices in these areas.

C. Provide weatherproof devices covers in areas designated WET or WET/CORROSIVE.

3.07 PANELBOARDS

A. Mount boxes for surface mounted panelboards so there is at least 1/2-in air space between the box and the wall.

B. Connect panelboard branch circuit loads so that the load is distributed as equally as possible between the phase busses.

C. Neatly typed circuit directories giving location and nature of load served. Install circuit directories in each panelboard.

D. Install markers on the front cover of all panelboards which identify the voltage rating. Markers shall be made of self sticking B-500 vinyl cloth printed with black characters on an Alert Orange background, 2-1/4-in high by 9-in wide, Style A as manufactured by W.H. Brady Co. or equal.

E. Install a 1-in by 3-in laminated plastic nameplate with 1/4-in black letters on a white background on each panelboard. Nameplate lettering shall be as shown on the Drawings. Nameplates shall be stainless steel screw mounted.

3.08 UNDERGROUND SYSTEM

A. Install raceways to drain away from buildings.

B. Reinforce raceway banks when conduits pass over newly excavated pipes.

C. The minimum cover for raceway banks shall be 24-in unless otherwise permitted by the Engineer.

D. Swab all raceways clean before installing cable.
E. Plug spare raceways and seal them watertight at all manholes, buildings and structures.

F. Seal the ends of raceways and make watertight at all handholes, buildings and structures.

3.09 GROUNDING

A. Run grounding electrode conductors in PVC conduits.

B. Install equipment grounding conductors with all feeders and branch circuits.

C. Bond all steel building columns in new structures together with ground wire in rigid conduit and connect to the distribution equipment ground bus.

D. Ground wire connections to structural steel columns shall be made with long barrel type one-hole heavy duty copper compression lugs, bolted through 1/2-in maximum diameter holes drilled in the column web, with stainless steel hex head cap screws and nuts.

E. Metal conduits stubbed into a motor control center shall be terminated with insulated grounding bushings and connect to the motor control center ground bus. Bond boxes mounted below motor control centers to the motor control center ground bus. Size the grounding wire in accordance with NEC Table 250-95, except that a minimum No. 12 AWG shall be used.

F. Liquid tight flexible metal conduit in sizes 1-1/2-in and larger shall have bonding jumpers. Bonding jumpers shall be external, run parallel (not spiraled) and fastened with plastic tie wraps.

G. Ground transformer neutrals to the nearest available grounding electrode with a conductor sized in accordance with NEC Article 250-94.

H. Seal exposed connections between different metals with No-Oxide Paint Grade A or equal.

I. Lay all underground grounding conductors slack and, where exposed to mechanical injury, protect by pipes or other substantial guards. If guards are iron pipe, or other magnetic material, electrically connect conductors to both ends of the guard. Make connections as specified herein.

J. Care shall be taken to ensure good ground continuity, in particular between the conduit system and equipment frames and enclosures. Where necessary, jumper wires shall be installed.

K. All grounding type receptacles shall be grounded to the outlet boxes with a No. 12 THW green conductor connected to the ground terminal of the receptacle and fastened to the outlet box by means of a grounding screw.

L. Test the grounding system. Resistance to ground testing shall be performed during dry season. Submit test results in the form of a graph showing the number of points measured (12 minimum) and the numerical resistance to ground.

M. Testing shall be performed before energizing the distribution system.
N. Notify the Engineer immediately if the resistance to ground for any building or system is greater than five ohms.

END OF SECTION
PART 1 - GENERAL

1.0 GENERAL SCOPE

A. The contractor shall engage the services of a recognized independent electrical testing firm to perform short circuit, coordination and arc flash studies as herein specified, as well as for the purpose of performing inspections and tests on all proposed electrical equipment supplied in this contract and on existing equipment as herein specified.

B. The testing firm shall provide all material, equipment, labor and technical supervision to perform such tests and inspections.

C. It is the purpose of these tests to assure that all tested electrical equipment, is operational and within industry and manufacturer's tolerances and is installed in accordance with design specifications.

D. The tests and inspections shall determine suitability for energization.

E. An itemized description of existing equipment to be inspected and tested is as follows:

1. Provide as built one line diagrams from the point of connection on the Utility Company transformer to the point of the first electrical subpanel or disconnecting device (located outside the main electrical room throughout the facility) fed from the main electrical switchgear room indicated on the drawings. The one line diagrams shall include switchgear and panel manufacturers and specifications; equipment frame size; overcurrent protection device rating, type and interrupting capacity; conduit size and type; conductor size, length and type; transformer size, type and specifications.

2. Provide plan view drawing indicating locations throughout the facility for all equipment indicated on the one line drawing. Provide routing of all feeders shown on the one line diagram with emphasis on exact location of underground feeders. Routings shall be electronically located with signal tracer equipment. Provide expanded scale plan view drawings of the existing main electrical switchgear room and expanded scale drawings of the wall elevations of the main switchgear room. Equipment identifications shall be consistent with that as shown on the one line diagram.

3. Provide peak and average demand loads of all panels and major distribution equipment over a one week period during the normal occupied times. Indicate the test result information on the one line diagram.

4. Provide testing of all feeder cables indicated on the one line diagram.

5. Provide testing of all circuit breakers indicated on the one line diagram.
6. Provide testing of all dry type transformers indicated on the one line diagram.

7. Provide testing on all metal enclosed switchgear and switchboard assemblies, disconnect switches, protective relays, metering and instrumentation, motors and motor control centers, as applicable.

8. The one line diagram and plan view equipment location drawings shall be on standard 24" X 36" media; drawn with a computer aided design package. The computer aided design package shall be AUTOCAD version 2009 or converted to Autocad version 2009. Partial site plan backgrounds of the facility shown on the contract documents will be available to the contractor on request. Submittals shall include reproducible plots of the drawings on paper velum or mylar and CD copies using PC format. The testing report shall be submitted on 8.5" X 11" paper bound with all field test data in appendix form. The report shall be signed and sealed by a registered professional engineer (P.E.) licensed in the State of Florida.

9. The above report and drawings shall be submitted within 30 days after the notice to proceed. Feeder routing information may be required prior to the submittal date to coordinate with building foundation construction.

F. The above existing facility report and drawings shall be used in the development of the final as-built drawings and report encompassing all new electrical equipment and testing and submitted with the operation and maintenance manuals prior to substantial completion of the project.

1.02 APPLICABLE CODES, STANDARDS, AND REFERENCES

A. All inspections and test shall be in accordance with the following codes and standards except as provided otherwise herein:

1. National Electrical Manufacturer's Association - NEMA
3. Institute of Electrical and Electronic Engineers - IEEE
6. State and local codes and ordinances
7. Insulated Cable Engineers Association - ICEA
8. Association of Edison Illuminating Companies - AEIC
9. Occupational Safety and Health Administration - OSHA
   a. ANSI/NFPA 70: National Electrical Code
   b. ANSI/NFPA 70B: Electrical Equipment Maintenance
   c. NFPA 70E: Electrical Safety Requirements for Employee Workplaces
   d. ANSI/NFPA 78: Lightning Protection Code

B. All inspections and test shall utilize the following references:
1. Project design specifications
2. Project design drawings
3. Manufacturer's instruction manuals applicable to each particular apparatus

1.03 QUALIFICATIONS OF TESTING FIRM

A. The testing firm shall be an independent testing organization which can function as an unbiased testing authority, professionally independent of the manufacturers, supplier, and installers of equipment or systems evaluated by the testing firm.

B. The testing firm shall be regularly engaged in the testing of electrical equipment devices, installations, and systems.

C. The testing firm shall meet OSHA criteria for accreditation of testing laboratories, Title 29, Part 1907, or be a Full Member company of the InterNational Electrical Testing Association.

D. The lead, on-site, technical person shall be currently certified by the InterNational Electrical Testing Association (NETA) or National Institute for Certification in Engineering Technologies (NICET) in electrical power distribution system testing.

E. The testing firm shall utilize engineers and technicians who are regularly employed by the firm for testing services.

F. The testing firm shall submit proof of the above qualifications when requested.

G. The terms used herein, such as test agency, test contractor, testing laboratory, or contractor test company, shall be construed to mean the testing firm.

H. NETA certified pre-qualified testing firms for this project are:
   1. Industrial Electric Testing, Inc.  (904) 260-8378 / (954) 456-7020
   2. Emerson Electro Test  (239) 693-7100 Fax (239) 693-7772

Other firms will be considered by the engineer on submittal of qualifications on or before 10 days prior to bid.

1.04 DIVISION OF RESPONSIBILITY

A. The contractor shall perform routine insulation-resistance, continuity and rotation test for all distribution and utilization equipment prior to and in addition to tests performed by the testing firm specified herein.

B. The contractor shall supply a suitable and stable source of electrical power to each test site.

C. The contractor shall notify the testing firm when equipment becomes available for acceptance tests. Work shall be coordinated to expedite project scheduling.

D. The testing firm shall notify the engineer prior to commencement of any testing.

E. Any system, material, or workmanship which is found defective on the basis of acceptance tests shall be reported to the engineer.

F. The testing firm shall maintain a written record of all tests and, upon completion of project, shall assemble and certify a final test report.
G. Safety and Precautions

1. Safety practices shall include, but are not limited to, the following requirements:
   a. Occupational Safety and Health Act.
   b. Accident Prevention Manual for Industrial Operations, National Safety council
   c. Applicable state and local safety operating procedures.
   d. Owner’s safety practices.
   e. National Fire Protection Association - NFPA 70E
   f. American National Standards for Personnel Protection

2. All test shall be performed with apparatus de-energized. Exceptions must be thoroughly reviewed to identify safety hazards and devise adequate safeguards.

3. The testing firm shall have a designated safety representative on the project to supervise the testing operations with respect to safety.

2.05 GENERAL

A. Suitability of Test Equipment

1. All test equipment shall be in good mechanical and electrical condition.

2. Digital multimeters used shall be RMS sensing when the variable to be measured contains harmonics, dc offset or any deviation from a pure sine wave.

3. Accuracy of metering in test equipment shall be appropriate for the test being performed, but not in excess of 2 percent of the scale used.

B. Test Instrument Calibration

1. The testing firm shall have a calibration program which assures that all applicable test instruments are maintained within rated accuracy.

2. The accuracy shall be directly traceable to the National Institute of Standards and Technology (NIST).

3. Field Instruments shall be calibrated at 6 month (analog) or 12 month (digital) intervals.

4. Dated calibration labels shall be visible on all test equipment.

C. Test Report

1. The test report shall include the following:
   a. Summary of project
   b. Listing of equipment tested
   c. Test results
   d. Analysis and recommendations

2. Furnish copies of the complete report to the engineer as directed.

2.06 SHORT-CIRCUIT ANALYSIS AND COORDINATION STUDY (for all new electrical equipment and all existing electrical equipment shown on the as built one line diagram as defined above)
A. Scope of Services

1. Provide a current and complete short-circuit study, arc flash study, equipment interrupting or withstand evaluation, and a protective-device coordination study for the electrical distribution system utilizing SKM Power Tools for Windows, version 6.5.2.1. or later.

2. The studies shall include all portions of the electrical distribution system from the normal and alternate sources of power throughout the low-voltage distribution system. Normal system operating method, alternate operation, and operations which could result in maximum fault conditions shall be thoroughly covered in the study.

B. Submittals

1. The studies shall be submitted to the project electrical engineer prior to granting final approval of the distribution equipment shop drawings and/or prior to release of equipment for manufacture.

C. Short Circuit Study

1. The study shall be in accordance with applicable ANSI and IEEE Standards.

2. The study input shall include the utility company’s short-circuit single and three phase contribution, with the X/R ratio, the resistance and reactance components of each branch impedance, motor and generator contributions, base quantities selected, and all other applicable circuit parameters.

3. Short circuit momentary duties and interrupting duties shall be calculated on the basis of maximum available fault current at each switchgear bus, switchboard, motor control center, distribution panelboard, pertinent branch circuit panelboards, and other significant locations through the system.

D. Arc Flash Study

1. An arc flash study shall be performed to determine the incident energy level in cal/cm², the arc flash boundary, the required personal protective equipment (PPE) to be used, and the hazard category level at each electrical panel. Arc flash hazard labels shall be provided and conform with the ANSI Z 535 layout standard according to NFPA 70E, article 130.

E. Equipment Evaluation Study

1. An equipment evaluation study shall be performed to determine the adequacy of circuit breakers, controllers, surge arresters, busways, switches, and fuses by tabulating and comparing the short circuit ratings of these devices with the maximum short-circuit momentary and interrupting duties. Evaluation study should be submitted prior to final approval of equipment submittals.

F. Protective Device Coordination Study

1. A protective device coordination study shall be performed to select or to check the selections of power fuse ratings, protective relay characteristics
and settings, ratios and characteristics of associated voltage and current
transformers, and low-voltage breaker trip characteristics and settings.

2. The coordination study shall include all voltage classes of equipment
from the utility's incoming line protective device down to and including
each motor control center and/or panelboard. The phase and ground
overcurrent protection shall be included, as well as settings for all other
adjustable protective devices.

3. The time current characteristics of the specified protective devices shall
be plotted on appropriate log-log paper. The plots shall include complete
titles, representative one-line diagram and legends, associated power
company's relays of fuse characteristics, significant motor starting
characteristics, complete parameters of transformers, complete operating
bands of low voltage circuit breaker trip curves, and fuse curves. The
coordination plots shall indicate the types of protective devices selected,
proposed relay taps, time dial and instantaneous trip settings, ANSI
transformer magnetizing inrush and withstand curves per ANSI C37.91,
cable damage curves, symmetrical and asymmetrical fault currents. All
requirements of the current National Electric Code shall be adhered to.
Reasonable coordination intervals and separation of characteristic curves
shall be maintained. The coordination plots for phase and ground
protective devices shall be provided on a complete system basis.
Sufficient curves shall be used to clearly indicate the coordination
achieved to each utility main breaker, primary feeder breaker, unit
substation primary protective device rated or more.

4. The selection and settings of the protective devices shall be provided
separately in a tabulated form listing circuit identification, IEEE device
number, current transformer ratios, manufacturer, type, range of
adjustment, and recommended settings. A tabulation of the
recommended power fuse selection shall be provided for all fuses in the
system. Discrepancies, problem areas, or inadequacies shall be
coordinated with the equipment suppliers and resolved with in the scope
of the project and at no additional cost to the owner.

G. Study Report

1. The results of the power system study shall be summarized in a final
report and made part of the operation and maintenance manuals.

2. The report shall include the following sections:

   a. Description, purpose, basis, written scope, and a single line
diagram of the portion of the power system which is included
within the scope of study.

   b. Tabulations of circuit breaker, fuse and other equipment ratings
versus calculated short circuit duties, and commentary regarding
same.

   c. Protective device time versus current coordination curves,
tabulations of relay and circuit breaker trip settings, fuse selection
and commentary regarding same.
d. Fault current tabulations including a definition of terms and a guide for interpretation.

H. Implementation

1. The contractor’s certified testing firm shall be responsible for the inspection, setting, testing, and calibration of the protective relays, circuit breakers, fuses and other applicable devices as recommended in the power systems study report.

2.07 INSPECTION AND TEST PROCEDURES

A. Switchgear and Switchboard Assemblies (for new and existing equipment shown on the one line diagram)

1. Visual and Mechanical Inspection

a. Inspect for physical, electrical, and mechanical condition.

b. Compare equipment nameplate information with latest one-line diagram.

c. Check for proper anchorage, required are clearances, physical damage and proper alignment.

d. Inspect all doors, panels, and sections for paint, dents, scratches, fit and missing hardware.

e. Verify that fuse and/or circuit breaker sizes and types correspond to drawings.

f. Verify that current and potential transformer ratios correspond to drawings.

g. Inspect all bus connections for high resistance. Use low resistance ohmmeter, or check tightness of bolted bus joints by using a calibrated torque wrench. Refer to manufacturer’s instructions for proper torque levels.

h. Test all electrical and mechanical interlock systems for proper operation and sequencing. Closure attempt shall be made on locked open devices. Opening attempt shall be made on locked closed devices. Key exchange shall be made with devices operated in off normal positions.

i. Clean entire switchgear using manufacturer’s approved methods and materials.

j. Inspect insulators for evidence of physical damage or contaminated surfaces.

k. Verify proper barrier and shutter installation and operation.
l. Lubrication: Verify appropriate contact lubricant on moving current carrying parts. Verify appropriate lubrication on moving and sliding surfaces.

m. Exercise all active components.

n. Inspect all mechanical indicating devices for proper operation.

2. Electrical Tests

a. Perform tests on all instrument transformers (current and potential).

b. Perform ground resistance tests.

c. Perform resistance tests through all bus joints with a low-resistance ohmmeter. Any joints that cannot be directly measured due to permanently installed insulation wrap shall be indirectly measured from the closest accessible connection. Compare bus connection resistance to values of similar connections.

d. Perform insulation resistance on each bus section, phase-to-phase and phase-to-ground for one (1) minute. Test voltages and minimum resistances shall be in accordance with manufacturer's published data or NETA ATS-1995 Table 10.1.

e. Perform an overpotential test on each bus section, each phase-to-ground with phases not under test grounded, in accordance with manufacturer's published data. If manufacturer has no recommendation for this test, it shall be in accordance with NETA ATS-1995 Table 10.11. The test voltage shall be applied for one (1) minute. Overpotential tests should not proceed until insulation-resistance levels measured in (d) are raised above minimum levels.

f. Perform insulation-resistance test on control wiring except where connected to solid state components.

g. Perform control wiring performance test. Use the elementary diagrams of the switchgear to identify each remote control and protective device. Conduct tests to verify satisfactory performance of each control feature.

h. Determine accuracy of all meters and calibrate watt hour meters in accordance with NETA ATS-1995. Verify multipliers.

i. Perform phasing check on double-ended switchgear to ensure proper bus phasing from each source.

j. Control Power Transformers - Dry Type
(1) Inspect for physical damage, cracked insulation, broken leads, tightness of connections, defective wiring, and overall general condition.

(2) Perform insulation-resistance tests. Perform measurements from winding-to-winding and windings-to-ground. Test voltages shall be in accordance with NETA ATS-1995 Table 10.1 unless otherwise specified by manufacturer.

(3) Perform secondary wiring integrity test. Disconnect transformer at secondary terminals and connect secondary wiring to correct secondary voltage. Confirm potential at all devices.

(4) Verify correct secondary voltage by energizing primary winding with system voltage. Measure secondary voltage with the secondary wiring disconnected.

(5) Verify correct function of control transfer relays located in switchgear with multiple power sources in following energized source for control power transformers.

3. Test Values: Verify bolt-torque values, insulation resistance and overpotential levels in conformance to NETA ATS-1995 standards or specified by manufacturer.

B. Transformers

1. Transformers - Small Dry Type, Air-Cooled (600 Volt and Below) (167 KVA single-phase or 500 KVA three-phase, and less)

(1) Inspect for physical damage, broken insulation, tightness of connections, defective wiring, and general condition.

(2) Thoroughly clean unit prior to making any tests.

(3) Perform insulation-resistance test. Calculate polarization index. Make measurements from winding-to-winding and windings-to-ground. Test voltages and minimum resistance shall be in accordance with NETA ATS-1995.

(4) Energize primary winding with system voltage. Measure secondary voltage with the secondary load disconnected. Record results.

a. Electrical Tests

(1) Perform insulation resistance tests, winding-to-winding and each winding-to-ground (voltage level in accordance with NETA ATS-1995 Table 10.5) utilizing a megohmmeter. Test duration shall be for ten minutes with resistances tabulated at 30 seconds, one minute and ten minutes. Calculate polarization index.

(2) Perform a turns-ratio test for each winding at all tap settings. Verify that tap setting is as specified. Verify that winding polarities are in accordance with nameplate.
(3) Perform insulation power-factor / dissipation-factor tests on all windings and correct to 20° C in accordance with test equipment manufacturer's instructions.

(4) Perform insulation power-factor / dissipation-factor tests (or hot collar watts-loss tests) on bushings and correct to 20° C in accordance with test equipment manufacturer's instructions.

(5) Measure resistance of each high-voltage winding in each no-load tap-changer position. Measure resistance of each low-voltage winding in each load tap-changer position, if applicable.

(6) If core strap is accessible, measure core insulation resistance at 500 volts dc.

(7) Remove a sample of insulating fluid in accordance with ASTM D-923. Sample should be tested for the following:
   a) Dielectric breakdown voltage: ASTM D-877 and / or D-1816
   b) Acid neutralization number: ASTM D-974
   c) Interfacial tension: ASTM D-971 or ASTM D-2285
   d) Color: ASTM D-1500
   e) Visual condition: ASTM D-1533
   f) Parts per million water: ASTM D-1533

(8) Remove a sample of insulating liquid in accordance with ASTM D3613 and perform dissolved gas analysis (DGA) in accordance with ANSI/IEEE C57.104 or ASTM D-3612.

C. Cables - Low Voltage - 600V Maximum

1. Visual and Mechanical Inspection
   a. Inspect cables for physical damage and proper connection in accordance with drawings.
   b. Test cable mechanical connections to manufacturer's recommended values or NETA ATS-1995 Table 10.12 using a calibrated torque wrench.
   c. Check cable color coding with engineer's specifications and National Electrical Code standards.

2. Electrical Tests
   a. Perform insulation-resistance test on each conductor with respect to ground and adjacent conductors. Applied potential shall be 1000 volts dc for 1 minute.
   b. Perform continuity test to insure proper cable connection.
   c. Test Values: evaluate results by comparison with cables of same length and type. Investigate any values less than 50 megohms.

D. Air Switches - Disconnects - Low-Voltage
1. Mechanical tests
   a. Compare equipment nameplate information with single-line diagram. Inspect for physical and mechanical condition.
   b. Check each fuse holder for adequate mechanical support of each fuse. Verify fuse sizes and types are in accordance with drawings. Check blade alignment. Exercise all active components.

2. Electrical tests
   a. Perform insulation-resistance tests on each pole, phase-to-phase and phase-to-ground with switch closed and across each open pole for one (1) minute. Test voltage shall be in accordance with manufacturer’s published data or NETA ATS-1995 Table 10.13. Minimum insulation resistance shall be accordance with manufacturer’s published data or NETA ATS-1995 Table 10.13.
   b. Measure contact resistance across each switchblade and fuse holder. Investigate any contact resistance values which deviate from adjacent poles or similar switches by more than 25 percent.
   c. Measure fuse resistance. Investigate fuse-resistance values that deviate from each other by more than 15 percent.

E. Circuit Breakers
   (Tests to be performed on all breakers except perform primary injection tests only on breakers rated 100 amps or greater.)

1. Circuit Breakers - Low Voltage insulated case
   a. Visual and Mechanical Inspection
      (1) Check circuit breaker for proper mounting and compare nameplate data to drawings and specifications.
      (2) Operate circuit breaker to ensure smooth operation.
      (3) Inspect case for cracks or other defects.
      (4) Check tightness of connections using calibrated torque wrench. Refer to manufacturer's instructions or NETA ATS-1995 Table 10.12 for proper torque levels.
   b. Electrical Tests
      (1) Perform a contact-resistance test.
      (2) Perform an insulation-resistance test at 1000 volts dc from pole to pole and from each pole to ground with breaker closed and across open contacts of each phase.
      (3) Determine long-time minimum pickup current by primary current injection where practical.
      (4) Perform long-time delay time-current characteristic tests by passing three hundred percent (300%) rated current through each pole separately. Record trip time.
(5) Determine short-time pickup and delay by primary current injection, if applicable.
(6) Determine ground-fault pickup and time delay by primary current injection, if applicable.
(7) Determine instantaneous pickup current by primary injection using run-up or pulse method.

c. Test Values

(1) Compare contact resistance or millivolt drop values to adjacent poles and similar breakers. Investigate deviations of more than fifty percent (50%). Investigate any value exceeding manufacturer's recommendations.
(2) Insulation resistance shall not be less than 100 megohms.
(3) Trip characteristic of breakers shall fall within manufacturer's published time-current characteristic tolerance band, including adjustment factors.
(4) All trip times shall fall within NETA ATS-1995 Table 10.7 or manufacturer's published time-current curves. Circuit breakers exceeding specified trip time at three hundred percent (300%) of pickup shall be tagged defective.
(5) Instantaneous pickup values shall be within values shown on NETA ATS-1995 Table 10.8.

F. Metering and Instrumentation

1. Visual and Mechanical Inspection
   a. Examine all devices for broken parts, shipping damage and tightness of connections.
   b. Verify that meter types, scales and connections are in accordance with drawings and specifications.

2. Electrical Tests
   a. Check calibration of meters at all cardinal points.
   b. Calibrate watt hour meters to one-half percent (0.5%).
   c. Verify all instrument multipliers.

G. Protective Relays

1. Visual and Mechanical Inspection
   a. Compare equipment nameplate data with drawings and specifications.
   b. Inspect relays and cases for physical damage. Remove shipping restraint material.
   c. Tighten case connections. Inspect cover for correct gasket seal. Clean cover glass. Inspect shorting hardware, connection
paddles, and/or knife switches. Remove any foreign material from
the case. Verify target reset.

d. Inspect relay for foreign material, particularly in disc slots of the
damping and electromagnets. Verify disk clearance. Verify contact
clearance and spring bias. Inspect spiral spring convolutions. Inspect disk and contacts for freedom of movement and correct travel. Verify tightness of mounting hardware and connections. Burnish contacts. Inspect bearings and/or pivots.
e. Set relays in accordance with coordination study supplied by
owner or consulting engineer.

2. Electrical tests
   a. Perform insulation-resistance test on each circuit-to-frame. Determine from the manufacturer's instructions the allowable procedures for this test for solid-state and microprocessor-based relays.
   b. Inspect targets and indicators
      (1) Determine pickup and drop-out of electromechanical targets.
      (2) Verify operation of all light-emitting diode (LED) indicators.
      (3) Set contrast for liquid-crystal display (LCD) readouts.
   c. Perform timing tests as described in NETA ATS-1995 section 7.9.3.

H. Grounding systems

1. Visual and Mechanical Inspection

2. Inspect ground systems for compliance with drawings and specifications.

3. Electrical Tests
   a. Perform fall-of-potential test or alternative in accordance with IEEE Standard 81-1991 on the main grounding electrode or system.
   b. Perform point-to-point tests to determine the resistance between the main grounding system and all major electrical equipment frames, system neutral, and / or derived neutral points.

4. The main ground electrode system impedance-to-ground should be no greater than five (5) ohms. Equipment grounds, depending on size and length of grounding conductor, should be only fractionally higher than system ground.

I. Ground-Fault Protection Systems

1. Visual and Mechanical Inspection

   a. Inspect for physical damage and compliance with drawings and specifications.
b. Inspect neutral main bonding connection to assure:
   (1) Zero-sequence sensing system is grounded.
   (2) Ground-strap sensing systems are grounded through sensing device.
   (3) Ground connection is made ahead of neutral disconnect link on zero-sequence sensing systems.
   (4) Grounded conductor (neutral) is solidly grounded.

c. Inspect control power transformer to ensure adequate capacity for system.

d. Manually operate monitor panels (if present) for: Trip test; No trip test; Non-automatic reset.

e. Record proper operation and test sequence.

f. Set pick-up and time-delay settings in accordance with the settings provided by the manufacturer.

2. Electrical Tests

   a. Measure system neutral insulation resistance to ensure no shunt ground paths exist. Remove neutral-ground disconnect link. Measure neutral insulation resistance and replace link.

   b. Determine the relay pickup current by current injection at the sensor and operate the circuit interrupting device.

   c. Test the relay timing by injecting one hundred fifty percent (150%) or greater of pickup current, or as specified by manufacturer.

   d. Test the system operation at fifty-five percent (55%) rated control voltage, if applicable.

   e. Test zone interlock systems by simultaneous sensor current injection and monitoring zone blocking function.

   f. On multiple source (tie breaker, etc.) systems, devise a simulation scheme that fully proves correct operation.

3. Test Parameters

   a. System neutral-to-ground insulation shall be a minimum of one (1) megohm.

   b. Relay timing shall be in accordance with manufacturer's published time-current characteristic curves but in no case longer than one (1) second for fault currents equal to or greater than 3000 amperes.
c. Insulation resistance values shall be in accordance with NETA ATS-1995 Table 10.13.

J. Motors

1. Visual and Mechanical Inspection
   a. Inspect for physical damage. Inspect for proper anchorage, mounting, grounding, connection and lubrication.

2. Electrical Tests - Induction Motors

   Motors 200Hp and Less - Test duration shall be for one (1) minute with resistances tabulated at 30 and 60 seconds. The dielectric absorption ratio will be calculated.

   b. Perform insulation resistance test on pedestal per manufacturer instructions.

   c. Perform insulation resistance test on surge protection device in accordance with this specification.

   d. Check resistance temperature detector (RTD) circuits for conformance with drawings. Check that metering or relaying devices using the RTD's are of the proper rating.

   e. Check that the motor space heater circuit is in proper operating conduction.

   f. Check all protective devices in accordance with other sections of these specifications.

   g. Perform a rotation test to ensure proper shaft direction if the motor has been disconnected.

   h. Measure running current and evaluate relative to load conditions and nameplate full load amperes.

K. Motor Control

1. Visual and Mechanical Inspection
   a. Inspect for physical damage, proper anchorage, and grounding.

   b. Inspect equipment for compliance with drawings and specifications.

   c. Check tightness of bolted connections using calibrated torque wrench.
2. Electrical Tests
   a. Insulation tests:
      (1) Measure insulation resistance of each combination starter, phase-to-phase and phase-to-ground, with starter contacts closed and protective device open. Test voltage shall be in accordance with NETA ATS-1995 Table 10.13. Refer to manufacturer's instructions for devices with solid-state components.
   b. Test motor overload units by injecting current through overload unit and monitoring trip time at three hundred percent (300%) of motor full-load current.
   c. Test circuit breakers in accordance with this specification.
   d. Perform operational tests by initiating control devices.

L. Surge Arresters

1. Low Voltage Surge Protection Devices
   a. Visual and Mechanical Inspection
      (1) Inspect for physical damage and compare nameplate data with drawings and specifications.
      (2) Inspect for proper mounting and adequate clearances.
      (3) Check tightness of connections by using calibrated torque wrench. Refer to manufacturer's instructions or NETA ATS-1995 Table 10.12 for proper torque levels.
      (4) Check ground lead on each device for individual attachment to ground bus or ground electrode.

   b. Electrical Tests
      (1) Perform insulation-resistance tests. Use manufacturer's Values or NETA ATS-1995 Table 10.13.

2. Automatic Transfer Switches
   a. Visual and Mechanical Inspection
      (1) Inspect for physical damage.
      (2) Compare nameplate information and connections to drawings and specifications.
      (3) Check tightness of all control and power connections.
      (4) Perform manual transfer operation.
      (5) Confirm proper lubrication.
(6) Check switch to ensure positive mechanical interlock between normal and alternate sources.

(7) Insure manual transfer warnings are attached and visible.

(8) Check that all covers, barriers and doors are secure.

b. Electrical Tests

(1) Perform insulation resistance tests, phase-to-phase and phase-to-ground, with switch in both source positions.

(2) Perform a contact resistance test across all main contacts.

(3) Verify settings and operation of control devices in accordance with the specifications provided by the manufacturer.

(4) Calibrate and test all relays and timers in accordance with these specifications.

(5) Perform automatic transfer tests:
(a) Simulate loss of normal power.
(b) Return to normal power.
(c) Simulate loss of emergency power.
(d) Simulate all forms of single phase conditions.

(6) Monitor and verify correct operation and timing of the following simulations:
(a) Normal voltage-sensing relays.
(b) Engine start sequence.
(c) Time delay upon transfer.
(d) Alternate voltage-sensing relays.
(e) Automatic transfer operation.
(f) Interlocks and limit switch function.
(g) Time delay and retransfer upon normal power restoration.
(h) Engine cool-down and shutdown feature.

2.08 SYSTEM FUNCTION TESTS

A. General

1. Perform system function tests upon completion of equipment tests. It is the purpose of system function tests to prove the proper interaction of all sensing, processing, and action devices.

2. Implementation

a. Develop test parameters for the purpose of evaluating performance of all integral components and their functioning as a complete unit within design requirements. Perform these tests.

b. Verify the correct operation of all interlock safety devices for fail-safe functions in addition to design function.

c. Verify the correct operation of all sensing devices, alarms, and indicating devices.
2.09 THERMOGRAPHIC SURVEY

A. Visual and Mechanical

1. Remove all necessary covers prior to scanning. Reinstall following scanning procedures.
2. Inspect for physical, electrical, and mechanical condition.

B. Equipment to be Scanned

1. All current-carrying devices.

C. Provide report indicating the following:

1. Problem area (location of "hot spot")
2. Temperature rise between "hot spot" and normal or reference area.
3. Cause of heat rise
4. Phase unbalance, if present
5. Areas scanned

D. Test Parameters

1. Scanning distribution system with ability to detect 1°C between subject area and reference at 30°C.
2. Equipment shall detect emitted radiation and convert detected radiation to visual signal.
3. Infrared surveys should be performed during periods of maximum possible loading but not less than forty percent (40%) of rated load of the electrical equipment being inspected.

END OF SECTION
SECTION 16110

RACEWAYS, BOXES, FITTINGS AND SUPPORTS

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. Furnish and install complete raceway systems as shown on the Drawings and as specified herein.

B. Home runs indicated are to assist the contractor in identifying raceways to be installed concealed or exposed. Raceways identified to be installed exposed on the Drawings shall be run near the ceilings or along the walls of the areas through which they pass and shall be routed to avoid conflicts with HVAC ducts, cranes and hoists, lighting fixtures, doors and hatches. Raceways indicated to be run concealed shall be run in the center of concrete floor slabs, in partitions, or above hung ceilings, as required.

C. Raceways and conductors are not shown completely on the Drawings, including but not limited to raceways and conductors: between lighting, switches, receptacles, other miscellaneous low voltage and signal systems, except where they are required to pass through a restricted or designated spaces. Conduit and wiring descriptions are indicated on the riser diagrams for the Fire Alarm, Security, CCTV, Telephone and Instrumentation Systems. Home runs indicated, are to assist the Contractor in identifying raceways to be installed concealed or exposed. Raceways and conductors shall be provided for complete and operating systems. Raceways indicated to be run exposed on the Drawings shall be run near the ceilings or along the walls of the areas through which they pass and shall be routed to avoid conflicts with HVAC ducts, cranes and hoists, lighting fixtures, doors and hatches, etc. Raceways indicated to be run concealed shall be run in the center of concrete floor slabs, in partitions, or above hung ceilings, as required.

1. All supports, hangers, bracing and appurtenances shall conform to the latest applicable requirements of the State of Florida Building Code except as supplemented or modified by the requirements specified in this Section.

1.02 SUBMITTALS

A. Submit, in accordance with Section 01330, detailed catalog information or drawings describing electrical and physical characteristics of all equipment specified in sufficient detail to show compliance with the Drawings and Specifications.

2.01 RACEWAYS AND FITTINGS

A. Steel Conduit and Fittings

1. Rigid metal conduit (GRS), couplings, factory elbows and fittings shall be heavy wall steel tubing with a hot-dipped galvanized finish inside and out after threading and shall comply with ANSI C 80.1 and UL/6.
2. Electrical metallic tubing (EMT), factory elbows and fittings shall be thin wall steel tubing with an electrically galvanized finish after fabrication and comply with ANSI C80.3 and UL/797.

3. Acceptable manufacturers:
   a. Allied Tube & Conduit Corp.
   b. LTV Steel Tubular Products Corp.
   c. Triangular PWC Inc.
   d. Or equal.

4. Rigid metal and intermediate metal conduit fittings shall be of the threaded type, and shall be steel or malleable iron, with a hot-dipped galvanized finish. Threadless fittings and split couplings are not allowed except in specific applications as approved by the Engineer.

5. Electrical metallic tubing fittings shall be of the rain tight, concrete tight, compression type with malleable iron or pressure cast steel body, steel hex type compression nut and electrically galvanized finish.

6. Acceptable manufacturers:
   a. Appleton Electric Co.
   b. O-Z Gedney Co.
   c. RACO Inc.
   d. Gould/Efcor
   e. Steel City
   f. Or equal

B. Aluminum Conduit and Fittings

1. Rigid Aluminum conduit, couplings, factory elbows and fittings shall be 6063 alloy and shall comply with ANSI C80.5.

2. Acceptable manufacturers:
   a. New Jersey Aluminum Corp.
   b. AFC Co.
   c. VAW of America, Inc.
   d. Or Equal.

C. Non Metallic Conduit and Fittings
1. PVC conduit shall be rigid polyvinyl chloride schedule 80. Rigid PVC conduit up to trade sizes 3-1/2-in shall comply with NEMA TC-2 and UL/651 and shall be sunlight resistant, rated for use with 90 degree C conductors in exposed, direct burial or concrete encased applications. Underground utility duct, 4-in trade size and above, shall be high density polyethylene (HDPE) Schedule 40 conduit encased in concrete, rated for use with 90 degree C conductors and shall comply with NEMA TC-8 and ASTM F512.

2. Connectors, couplings, fittings and ancillary materials shall be supplied by the conduit manufacturer.

3. Acceptable manufacturers:
   a. Carlon Corp.
   b. Certained Corp.
   c. Conux Pipe Systems, Inc.
   d. Or equal.

D. Liquid-tight Flexible Metal Conduit, Couplings and Fittings

1. Liquid-tight flexible metal conduit shall be square locked, galvanized steel flexible conduit with a moisture proof, flame resistant, polyvinyl chloride jacket, for use with rigid metal conduit systems. Sealtite, Type UA, manufactured by the Anaconda Metal Hose Div.; Anaconda American Brass Co.; American Flexible Conduit Co., Inc.; Universal Metal Hose Co. or equal.

2. Liquid-tight conduit fittings shall be hot-dipped mechanically galvanized, positive grounding, screw in type. Provide external bonding lugs on sizes 1-1/4-in and larger. Box connectors shall have insulated throats as manufactured by the Thomas & Betts Co.; Crouse-Hinds Co. or equal.

3. Acceptable Manufacturers:
   a. American Flexible Conduit Co.
   b. Anaconda Metal Hose/ANAMET Inc.
   c. Electri-flex Co.
   d. Thomas & Betts
   e. O-Z Gedney
   f. Or equal
      a. Thomas and Betts “XTRACFLEX LTC”
      b. CARLON “CARFLEX”
      c. Hubel/Kellems “PolyTuff I”
2.02 BOXES AND FITTINGS

A. Dry and Damp Location Boxes and Fittings

1. Outlet boxes shall be zinc-galvanized, extra depth, pressed steel with knockouts and of size and type suitable for the intended application.

2. Boxes that are less than 100 cubic inches in size used for junction or pull boxes shall be zinc galvanized pressed steel not less than 14 USS gauge with appropriate blank covers, minimum size 4-11/16-in square by 2-1/8-in deep.

3. Boxes that are 100 cubic inches and larger shall be constructed of hop dip galvanized sheet steel without knockouts. Covers shall be secured with round head brass machine screws. All joints shall be welded and ground smooth.

4. Terminal cabinets shall be NEMA 12 sheet steel unless otherwise shown on the Drawings. Boxes shall be painted and have continuously welded seams. Welds shall be ground smooth and galvanized. Box bodies shall be flanged and shall not have holes or knockouts. Box bodies shall not be less than 14 gauge metal and covers shall not be less than 12 gauge metal. Terminal boxes shall be furnished with latching hinged doors, terminal mounting straps and brackets. Terminal blocks shall be rated not less than 20A, 600V.

5. Acceptable Manufacturers:
   a. Appleton
   b. Raco
   c. Steel City
   d. Hoffman
   e. Electromate Division of Robroy Ind.
   f. Wiegmann

B. Wet Location Boxes and Fittings

1. NEMA 4 terminal boxes, junction boxes, pull boxes, etc, shall be sheet Type 316 stainless steel unless otherwise shown on the Drawings. Boxes shall have continuously welded seams and mounting feet. Welds shall be ground smooth. Boxes shall be flanged and shall not have holes or knockouts. Box bodies shall not be less than 14 gauge metal and covers shall not be less than 12 gauge metal. Covers shall be gasketed and fastened with stainless steel clamps. Terminal boxes shall be furnished with hinged doors, terminal mounting straps and brackets. Terminal blocks shall be NEMA type, not less than 20 Amps, 600 Volt.

2. Cast or malleable iron device boxes shall be Type FD. Boxes and fittings shall have cadmium-zinc finish with cast covers and stainless steel screws.
3. Cast aluminum device boxes shall be Type FD. Boxes and fittings shall be copper free aluminum with cast aluminum covers and stainless steel screws.

4. Acceptable Manufacturers:
   a. Appleton
   b. Crouse-Hinds
   c. Steel City
   d. Hoffman
   e. Electromate - Division of Robroy Ind.
   f. Or equal

C. Corrosive Location Boxes
   1. NEMA 4X terminal boxes, junction boxes and pull boxes shall be stainless steel with stainless steel hardware and gasketed covers. Terminal boxes shall be furnished with hinged doors, terminal mounting straps and brackets. Terminal blocks shall be NEMA type, not less than 20 Amps, 600 Volt.

   2. Acceptable Manufacturers:
      a. Hoffman
      b. Stahlin - Division of Robroy Ind.
      c. English Electric
      d. Or equal

E. Miscellaneous Fittings
   1. Flexible couplings shall be type ECGJH as manufactured by the Crouse-Hinds Co.; Appleton Electric Co.; Killark Electric Manufacturing Co. or equal.

   2. Conduit hubs shall be as manufactured by Myers Electric Products, Inc. or equal.

   3. Conduit wall seals for new concrete walls below grade shall be O.Z./Gedney Co., Type WSK; [Linkseal]; Spring City Electrical Manufacturing Co., Type WDP or equal.

   4. Conduit wall seals for cored holes shall be Type CSMC as manufactured by the O.Z./Gedney Co. or equal.

   5. Conduit wall and floor seals for sleeved openings shall be Type CSMI as manufactured by the O.Z./Gedney Co. or equal.

   6. Combination expansion-deflection fittings embedded in concrete shall be Type XD as manufactured by the Crouse-Hinds Co.; Type AXDX as manufactured by O.Z./Gedney Co.; Type DF as manufactured by Appleton Electric Co. or equal.
7. Combination expansion-deflection fittings installed exposed shall be Type XD as manufactured by Crouse-Hinds Co.; Type AXDX as manufactured by O.Z. Gedney Co.; Type DF as manufactured by Appleton Electric Co. or equal.

8. Conduit sealing bushings shall be O.Z./Gedney, Type CSB or equal.

9. Grounding bushings shall be malleable iron with integral insulated throat rated for 150 degrees C, with solderless lugs as manufactured by Crouse Hinds/Cooper, Series HGLL; Appleton, Series GiB; O.Z./Gedney, Type HBLG or equal.

2.03 HARDWARE

A. Conduit Mounting Equipment

1. In dry indoor areas, hangers, rods, backplates, beam clamps, channel, etc. shall be hot dipped galvanized iron or steel.

2. Stainless steel channel with stainless steel hardware shall be used in areas designated "WET" or "CORROSIVE" on the Drawings and in outdoor locations. Fiberglass channel shall be resistant to the chemicals present in the area in which it is used. Stainless steel shall be Type 316.

3. Furnish any and all necessary supports, brackets, conduit sleeves, racks and bracing as required. All boxes and hardware shall be galvanized zinc plated steel except that stainless steel shall be used in areas designated as "WET" "DAMP" or "CORROSIVE" on the Drawings.

B. Conduit Identification Plates

1. Conduit identification plates shall be embossed stainless steel with stainless steel band, permanently secured to the conduit without screws.

2. Identification plates shall be as manufactured by the Panduit Corp. or equal.

C. Wall and Floor Slab Opening Seals

1. Wall and floor slab openings shall be sealed with a UL approved expanding material which equals or exceeds the fire rating of the wall or floor construction as manufactured by the Thomas & Betts Corp.; Pro Set Systems; Neer Mfg. Co.; Specified Technologies, Inc. or equal.

D. Cold Galvanizing Compound

1. Cold galvanizing compound shall be as manufactured by ZRC Products Company, a Division of Norfolk Corp. or equal. Compound shall be used only as authorized by the Engineer.

E. Conduit Supports

1. Trapezes

   a. In dry indoor areas, beams, channels, struts, hangers, bracing, rods, beam clamps, accessories and components shall be hot dipped galvanized steel.
b. Stainless steel channels, struts or fiberglass beams, channels, struts with stainless steel hangers, bracing, rods, beam clamps, accessories and components shall be used in areas designated “WET”, “DAMP” and “CORROSIVE” where indicated and in outdoor locations. Fiberglass channels shall be resistant to the chemicals present in the area in which it is used.

2. Flush Mounted Supports
   a. In dry indoor areas, channels, struts, accessories and components shall be hot dipped galvanized steel.
   b. Stainless steel channels, struts or fiberglass channels, struts with stainless, accessories and components shall be used in areas designated “WET”, “DAMP” and “CORROSIVE” where indicated and in outdoor locations. Fiberglass channels shall be resistant to the chemicals present in the area in which it is used.

3. Conduit Racks
   a. In dry indoor areas, conduit racks, accessories and components shall be hot dipped galvanized steel.
   b. Stainless steel conduit racks or fiberglass conduit racks with stainless, accessories and components shall be used in areas designated “WET”, “DAMP” and “CORROSIVE” where indicated and in outdoor locations. Fiberglass channels shall be resistant to the chemicals present in the area in which it is used.

4. Conduit Hangers
   a. In dry indoor areas, conduit clamps, rods, beam clamps, bracing, accessories and components shall be galvanized steel.
   b. Stainless steel conduit clamps, rods, beam clamps, bracing, accessories and components shall be used in areas designated “WET”, “DAMP” and “CORROSIVE” where indicated and in outdoor locations.

5. Adjustable steel and plastic band hangers, adjustable band hangers, adjustable swivel ring hangers and J-hangers shall not be allowed.

6. All hangers, bracing, rods, beam clamps, accessories and components shall be as manufactured by the Carpenter & Paterson Inc.; Grinnell Corporation; B-Line Systems Inc. or equal.

PART 3 - EXECUTION

3.01 RACEWAY APPLICATIONS
   A. Refer to Table 16110-A for specific raceway application requirements.
B. All conduit of a given type shall be the product of one manufacturer.

C. Refer to Section 16600 for underground applications.

<table>
<thead>
<tr>
<th>Location/Circuit Type</th>
<th>Raceway Type</th>
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</table>
| All locations         | ▪ Exposed – Rigid aluminum, Schedule 80 PVC.  
▪ Concealed – Rigid aluminum, Schedule 80 PVC  
▪ Underground - Galvanized rigid steel (GRS) conduit in concrete reinforced duct bank. |
| Clean, dry finished areas - offices, administrative areas, lobbies, control room, lunch room, toilets, and laboratories, etc. | ▪ Conceal raceways in walls above hung ceilings in rooms and areas that have finished interiors.  
Surface raceway for multiple receptacle, voice, and data outlets in labs and control rooms or in offices where specified.  
▪ 3/4 or 1-in electrical metallic tubing (EMT) for lighting, light switch, and receptacle circuits exposed above hung ceilings or concealed in partition walls. Galvanized rigid steel (GRS) above 1-in.  
▪ Flexible, armor interlocked cable assembly (Type MC) or flexible conduit may be used as branch circuit wiring in these areas. |
| Clean, dry non-finished areas - electrical rooms, generator rooms, mechanical rooms, shops, dry storage, etc. | ▪ Exposed conduit for power wiring, lighting, switch, and receptacle circuits - Galvanized rigid steel (GRS).  
▪ Concealed conduit for power wiring, lighting, switch, and receptacle circuits – Schedule 80 PVC conduit when embedded within concrete floor slabs. GRS when embedded within masonry block walls. |
| Corrosive areas - chemical storage and handling areas, underground vaults, within tanks or clear wells, filter pipe galleries and locations where designated DAMP, WET, CORROSIVE on the Drawings. | ▪ Exposed conduit for power wiring, lighting, switch, and receptacle circuits – PVC schedule 80 Conduit 3/4 and 1-in.  
▪ Concealed conduit for power wiring, lighting, switch, and receptacle circuits - Schedule 80 PVC conduit when embedded within concrete floor slabs or structures. |
| Outdoor areas - all locations. | ▪ Exposed conduit for power wiring, lighting, switch, and receptacle circuits - rigid aluminum. PVC conduit shall not be used exposed. |

3.02 BOX APPLICATIONS
A. Unless otherwise specified herein or shown on the Drawings, all boxes shall be metal.

B. Exposed switch, receptacle and lighting outlet boxes and conduit fittings shall be cast or malleable iron, except that cast aluminum shall be used with aluminum conduit and non-metallic PVC shall be used with PVC.

C. Concealed switch, receptacle and lighting outlet boxes shall be pressed steel.

D. Terminal boxes, junction boxes and pull boxes shall have NEMA ratings suitable for the location in which they are installed, as specified in Section 16000.

E. Boxes flush in block, brick or tile walls shall be located at a course line and provided with square tile covers. Flush boxes shall not project beyond the finished surfaces nor shall surfaces project more than 1/8-in beyond the box enclosure. Wiring devices located in close proximity to each other shall be installed in one solid gang box with single cover.

F. All conduit bodies and pulling outlets shall comply with NEC wire bending space requirements. Mogul type fittings shall be used for sizes 2-1/2-in and larger.

3.03 FITTINGS APPLICATIONS

A. Combination expansion-deflection fittings shall be used where exposed rigid metal conduits cross structure expansion joints or in straight runs where expansion is anticipated. Combination expansion-deflection fittings shall be installed where embedded rigid metal conduit cross structural expansion joints. Refer to Structural Drawings for expansion joint locations. Provide bonding jumpers around fittings.

B. All underground conduit penetrations at walls or other structures shall be sealed watertight. Conduit wall seals and sleeves shall be used in accordance with the manufacturer’s installation instructions and the details shown on the Drawings.

C. Conduit sealing bushings shall be used to seal conduit ends exposed to the weather and at other locations shown on the Drawings.

1. Internally and externally seal each conduit entering or leaving any area containing noxious gases to prevent contamination into clean areas via the conduit system. Areas requiring this protection are rooms where chlorine, ammonia and ozone are stored, generated or handled. Caulking material for conduit internal use shall be synthetic elastomer type, 3M, Series CP25 or equal. External sealing shall be in accordance with the typical details shown on the Drawings.

E. Insulated throat grounding bushings shall be used where specified herein, in Section 16660 and where conduits stub up into electrical equipment such as MCC’s, switchgear, etc.

3.04 INSTALLATION

A. No conduit smaller than 3/4-in electrical trade size shall be used, nor shall any have more than the equivalent of three 90 degree bends in any one run. Pull boxes shall be provided as required by the NEC 2008 after every 270 degrees of bends and for straight run not to exceed 200 feet or as directed.
B. No wire shall be pulled until the conduit system is complete in all details; in the case of concealed work, until all rough plastering or masonry has been completed; in the case of exposed work, until the conduit system has been completed in every detail.

C. All conduit which may under any circumstance contain liquids such as water, condensation, liquid chemicals, etc, shall be arranged to drain away from the equipment served. If conduit drainage is not possible, conduit seals shall be used to plug the conduits. The ends of all conduits shall be temporarily plugged to exclude dust, moisture and debris from entering during construction.

D. Conduit ends exposed to the weather shall be sealed with conduit sealing bushings.

E. Conduits noted as spare shall be capped or plugged at both ends with easily removable fittings.

F. Conduit terminating in NEMA 3R, 4, 4X and 12 enclosures shall be terminated with Myers type conduit hubs.

G. Conduit terminating in pressed steel boxes shall have double locknuts and insulated bushings.

H. Conduits containing equipment grounding conductors and terminating in sheet steel boxes shall have insulated throat grounding bushings.

I. Conduits shall be installed using threaded fittings except for PVC or EMT.

J. The use of running threads is prohibited. Where such threads are necessary, a 3-piece union shall be used.

K. All conduits entering or leaving a motor control center, switchboard or other multiple compartment enclosure shall be stubbed up into the bottom horizontal wireway or other manufacturer’s designated area, directly below the vertical section in which the conductors are to be terminated. The 3-in extension of conduit above the floor slab or concrete equipment pad may be reduced to a dimension that suits the equipment manufacturer’s installation requirements if the 3-in stub-up interferes with the equipment being provided.

L. Rigid galvanized steel conduits buried in earth shall be completely painted with bitumastic.

M. Rigid galvanized steel conduits which have been field cut and threaded shall be painted with cold galvanizing compounds.

R. Conduit sealing and drain fittings shall be installed on all conduits entering and leaving any area containing noxious gases to prevent contamination into clean areas via the conduit system. Areas requiring this protection are: rooms where [chlorine, ammonia, and ozone] are stored, generated or heated. A sealing compound installation schedule shall be presented to the engineer for approval. Each installation shall be signed off by the Contractor and the engineer and each fitting shall be legibly marked with red paint to indicate that the sealing compound has been installed.

S. Liquid-tight flexible metal conduit shall be used for all motor terminations, the primary and secondary of transformers, generator terminations and other equipment where
vibration is present or may require removal. Non-metallic flexible conduit can be used with rigid PVC conduit systems.

T. Flexible couplings shall be used all motor terminations and other equipment where vibration is present.

U. Aluminum fittings and boxes shall be used with aluminum conduit. Aluminum conduit shall not be imbedded in concrete. Aluminum conduit shall be isolated from other metals with plastic sleeves or plastic-coated hangers. Strap wrenches shall be used for tightening aluminum conduit.

V. Flexible metallic conduit shall be used for recessed fluorescent fixtures in hung ceilings to connect fixtures to the conduit system.

X. PVC conduit to non-metallic box connections shall be made with PVC socket to male thread terminal adapters with neoprene O-ring and PVC round edge bushings.

Y. PVC conduit shall be supported with non-metallic clamps, non-metallic racks and stainless steel hardware.

Z. Expansion fittings shall be used on exposed runs of PVC conduit where required for thermal expansion. Installation and number of fittings shall be as recommended by manufacturer.

AA. PVC boxes, conduit fittings, etc, with integral hubs shall be solvent welded directly to the PVC conduit system.

AB. Non-metallic boxes with field drilled or punched holes shall be connected to the PVC conduit system with threaded and gasketed PVC Terminal Adapters.

AC. Conduit supports, other than for underground raceways, shall be spaced at intervals not exceeding the distance required by the [NEC] to obtain rigid construction.

AD. Single conduits shall be supported by means of one-hole pipe clamps in combination with one-screw back plates, to raise conduits from the surface. Multiple runs of conduits shall be supported on fabricated channel trapeze type racks with steel horizontal members and threaded hanger rods. The rods shall be not less than 3/8-in diameter. Surface mounted panel boxes, junction boxes, conduit, etc, shall be supported by spacers to provide a minimum of 1/2-in clearance between wall and equipment.

AE. Conduit Supports (Other than Underground Raceways)

1. Trapezes
   a. Conduit support trapezes shall be vertically supported every 10-ft or less, as required to obtain rigid conduit construction.
   
   b. Horizontal seismic restraints shall be spaced at 40-ft or less. There shall be at least one horizontal restraint per horizontal run.
   
   c. Attachment to structural steel shall be by beam clamps or welded beam attachment. C-clamps will not be allowed for vertical hangers. Side beam clamps with beam hooks shall be used for seismic restraint only.
d. Attachment to concrete shall be cast-in-place inserts, cast-in-place welded plates with welded studs or stainless steel adhesive anchors.

2. Flush Mounted Supports
   a. Support shall be spaced 10-ft or less, as required to obtain rigid conduit construction.
   b. Attachment to concrete shall be with cast-in-place inserts, cast-in-place welded plates with welded studs or stainless steel adhesive anchors.

3. Conduit Racks
   a. Support shall be spaced 10-ft or less, as required to obtain rigid conduit construction.
   b. Conduit hangers shall be vertical supported 10-ft or less, as required to obtain rigid conduit construction.
   c. Attachment to structural steel shall be by beam clamps or welded beam attachment. C-clamps will not be allowed for vertical hangers. Side beam clamps with beam hooks shall be used for seismic restraint only.
   d. Attachment to concrete shall be with “Hilti” type anchors.

5. All reinforcing bars shall be located by the Electrical Subcontractor with the use of a rebar locator prior to installing adhesive capsule type anchors. Mark the location of all reinforcing bars in an area bounded by a line drawn at least 18-in from the edge of the support bearing/weld plates on all four sides of the bearing/weld plates prior to fabricating and installing bearing/weld plates.

6. Where interference occurs, adjust anchor locations to clear reinforcing bars and alter support configuration at no additional cost to the Owner.

AF. Miscellaneous steel for the support of fixtures, boxes, transformers, starters, contactors, panels and conduit mounted in interior spaces shall be furnished and installed. Channel supports shall be ground smooth and fitted with plastic end caps. Areas designated as Damp/Corrosive shall use stainless steel supports and fasteners. All other areas shall use hot dipped galvanized steel supports.

AG. Steel channels, flat iron and channel iron shall be furnished and installed for the support of all electrical equipment and devices, where required, including all anchors, inserts, bolts, nuts, washers, etc, for a rigid installation. Channel supports shall be ground smooth and fitted with plastic end caps. Materials of construction shall be as described in the preceding paragraph.

AH. All conduits on exposed work, within partitions and above suspended ceilings, shall be run at right angles to and parallel with the surrounding wall and shall conform to the form of the ceiling. No diagonal runs will be allowed. Bends in parallel conduit runs shall be concentric. All conduits shall be run perfectly straight and true.

AJ. Where conduits pass through openings in walls or floor slabs, the remaining openings shall be sealed against the passage of flame and smoke in accordance with UL
requirements and the details shown on the Drawings. The sealing method shall have a UL fire rating, which equals or exceeds the fire rating of the wall or floor construction.

AK. Conduits shall not cross pipe shafts, access hatches or vent duct openings. They shall be routed to avoid such present or future openings in floor or ceiling construction.

AL. Conduits passing from heated to unheated spaces, exterior spaces, refrigerated spaces, cold air plenums, etc, shall be sealed with "Duxseal" as manufactured by Manville or seal fitting to prevent the accumulation of condensation.

AM. Conduits shall be located a minimum of 3-in from hot water piping. Where crossings are unavoidable, the conduit shall be kept at least 1-in from the covering of the pipe crossed.

AN. Mandrels shall be pulled through all existing conduits which will be reused and through all new conduits 2-in in diameter and larger prior to installing conductors.

AO. 3/16-in polypropylene pull lines shall be installed in all new conduits noted as spares or designated for future equipment. Conduit noted as spare shall be capped or plugged at both ends with easily removable fittings.

AP. Where no type or size is indicated for junction boxes, pull boxes or terminal cabinets, they shall be sized in accordance with the requirements of NEC Article 314. Enclosure type and material shall be as specified herein.

AQ. Pull or junction boxes shall be furnished and installed where shown on the Drawings, in every 200 feet of straight conduit runs or in runs where more than the equivalent of four 90 degree bends occur or at any point necessary for wire pulling and splicing. Splices shall not be made in pulling elbows.

END OF SECTION
PART 1 - GENERAL

1.01 SCOPE OF WORK

A. Furnish, install and test all wire, cable and appurtenances as shown on the Drawings and as specified herein.

1.02 SUBMITTALS

A. Submit, samples of proposed wire. Each sample shall have the size, type of insulation and voltage stenciled on the jacket.

B. Approved samples will be sent to the project location for comparison by the Resident Engineer with the wire actually installed.

C. Installed unapproved wire shall be removed and replaced at no additional cost to the Owner.

D. Submit, in accordance with Section 01330, detailed catalog information or drawings describing electrical and physical characteristics of all equipment specified in sufficient detail to show compliance with the Drawings and Specifications.

1.03 DELIVERY, STORAGE AND HANDLING

A. Carefully handle all conductors to avoid kinks and damage to insulation.

PART 2 PRODUCTS

2.01 GENERAL

A. Wires and cables shall be of annealed, 98 percent conductivity, soft drawn copper.

B. All conductors shall be stranded, except that lighting and receptacle wiring may be solid.

C. Except for control, signal and instrumentation circuits, wire smaller than No. 12 AWG shall not be used.

2.02 BUILDING WIRE

A. Wire for lighting, receptacles and other circuits not exceeding 150 Volts to ground shall be NEC type THHN/THWN as manufactured by the Okonite Co.; Carol Cable Co. Inc.; Pirelli Cable Corp. or equal.

B. Wire for circuits over 150 Volts to ground shall be NEC type THHN/THWN as manufactured by the Okonite Co.; Carol Cable Co. Inc.; Pirelli Cable Corp. or equal.
C. Wire for direct burial outdoor lighting circuits shall be NEC type USE as manufactured by the Okonite Co.; Carol Cable Co. Inc.; Pirelli Cable Corp. or equal.

D. Multi-conductor motor power cable shall be (4) conductor. (3) stranded TC circuit conductors plus (1) ground with TC braid shield and TC drain wire. Conductors shall be XHHW-2/RHW-2 with XLPE insulation (circuit conductors). Ground wire PVC insulation with overall jacket TC-ER rated meeting UL 1277 and IEEE 83. Cable shall be flame resistant, non-propagating and suitable for installation in a Class I, Division II hazardous location and for direct burial in earth. Cable shall be as manufactured by the Belden Co.Pt. no. 29501 #14; 29502 #12; 29503 #10; 29504 #8; 29505 #6; 29506 #4; 29507 #2.

2.03 CONTROL, STATUS AND ALARM WIRE

A. Wire shall be No.14 AWG NEC type THHN/THWN, stranded as manufactured by the Okonite Co.; Carol Cable Co. Inc.; Pirelli Cable Corp. or equal.

B. Multi-conductor control cable, where shown on the Drawings, shall be stranded, No.14 AWG, tinned copper 300 Volt, polyvinyl chloride insulated, nylon jacket over insulation, polyvinyl chloride jacket overall, Type TC as manufactured by the Okonite Co.; Pirelli Cable Corp. or equal.

2.04 INSTRUMENTATION WIRE

A. Wire for process instrumentation signals (i.e. 1-5 VDC, 4-20 mA DC), potentiometer and similar signals shall be:

1. Single pair cable:
   a. Conductors: 2 No. 16 stranded and twisted on 2-in lay
   b. Insulation: PVC with 300 Volt, 105 degrees C rating
   c. Shield: 100 percent mylar tape with drain wire
   d. Jacket: PVC with UL Subject 13, UL 1581 and manufacturers’ identification
   e. Max overall diameter: 0.262-in
   f. Miscellaneous: UL Subject 13, Type PLTC
   g. Manufacturer: Belden No. 8719 or equal

2.05 FIBER OPTIC CABLE

A. Wire for telephone and instrumentation communications.

1. Dielectric Cable 12 Strand Fiber. Corning ALTOS Fiber Cable 121 strand fiber. Part No. 012KW4-T4130A20.
2.06 SPLICES (POWER CONDUCTORS)

A. Compression type “Hypress” connectors shall be insulated with a heat shrink boot or outer covering and epoxy filling. Splice kits shall be as manufactured by Burndy; Ideal Industries; 3M Co. or equal.

B. Solderless pressure connectors shall be self-contained, waterproof and corrosion-proof units incorporating prefilled silicone grease to block out moisture and air. Connectors shall be sized according to manufacturer's recommendations. The connectors shall be UL listed and CSA approved, as manufactured by King Technology, St Louis, MO; Ideal Industries, Inc., Sycamore, IL or equal.

2.06 MOTOR CONNECTIONS

A. Motor connections shall be ring type mechanical compression terminations installed on the branch circuit wires and the motor leads and secured with bolt, nut and spring washer. Connections shall be insulated with a Raychem Type RVC, roll-on stub insulator or equal.

2.07 TERMINATION AND SPLICES (CONTROL, STATUS AND ALARM CONDUCTORS)

A. Termination connectors shall be of the locking fork-end (upturned leg ends) type as manufactured by Ideal Industries; 3M Co.; Panduit Corp. or equal.

B. Insulated compression type connectors shall be of the expanded vinyl insulated parallel or pigtail type as manufactured by Ideal Industries; 3M Co.; Panduit Corp. or equal.

C. Solderless pressure connectors shall be self-contained, waterproof and corrosion-proof units incorporating prefilled silicone grease to block out moisture and air. Connectors shall be sized according to manufacturer's recommendations. The connectors shall be UL listed and CSA approved, as manufactured by King Technology, St Louis, MO; Ideal Industries, Inc., Sycamore, IL or equal.

2.08 TERMINATIONS (INSTRUMENTATION CABLES)

A. Termination connectors shall be of the locking fork-end (upturned leg ends) type as manufactured by Ideal Industries; 3M Co.; Panduit Corp. or equal.

2.09 WIRE AND CABLE MARKERS

A. Wire and cable markers shall be "Omni-Grip" as manufactured by the W.H. Brady Co.; Thomas & Betts Co.; 3M Co. or equal.

B. Wire and cables with diameters exceeding the capacity of the "Omni-Grip" shall be marked with pre-printed, self-adhesive vinyl tapes as manufactured by the W.H. Brady Co.; Panduit Corp. or equal.

2.10 WALL AND FLOOR SLAB OPENING SEALS

A. Wall and floor slab openings shall be sealed with "FLAME-SAFE" as manufactured by the Thomas & Betts Corp. or equal.
PART 3 - EXECUTION

3.01 INSTALLATION

A. Uniquely identify all wires, cables and each conductor of multi-conductor cables (except lighting and receptacle wiring) at each end with wire and cable markers.

B. Use lubrications to facilitate wire pulling. Lubricants shall be UL approved for use with the insulation specified.

3.02 WIRE COLOR CODE

A. All wire shall be color coded or coded using electrical tape in sizes where colored insulation is not available. Where tape is used as the identification system, it shall be applied in all junction boxes, manholes and other accessible intermediate locations as well as at each termination.

B. The following coding shall be used:

<table>
<thead>
<tr>
<th>System</th>
<th>Wire</th>
<th>Color</th>
</tr>
</thead>
<tbody>
<tr>
<td>240/120 Volts</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Single-Phase, 3 Wire</td>
<td>Line 1</td>
<td>Black</td>
</tr>
<tr>
<td></td>
<td>Line 2</td>
<td>Red</td>
</tr>
<tr>
<td>208Y/120, Volts</td>
<td>Neutral</td>
<td>White</td>
</tr>
<tr>
<td>3 Phase, 4 Wire</td>
<td>Phase A</td>
<td>Black</td>
</tr>
<tr>
<td></td>
<td>Phase B</td>
<td>Red</td>
</tr>
<tr>
<td></td>
<td>Phase C</td>
<td>Blue</td>
</tr>
<tr>
<td>480Y/277 Volts</td>
<td>Neutral</td>
<td>White</td>
</tr>
<tr>
<td>3 Phase, 4 Wire</td>
<td>Phase A</td>
<td>Brown</td>
</tr>
<tr>
<td></td>
<td>Phase B</td>
<td>Orange</td>
</tr>
<tr>
<td></td>
<td>Phase C</td>
<td>Yellow</td>
</tr>
</tbody>
</table>

3.03 TERMINATIONS AND SPLICES

A. Power conductors: Termination shall be die type or set screw type pressure connectors as specified. Splices (where allowed) shall be die type compression connector and waterproof with heat shrink boot or epoxy filling for copper conductors #4 AWG and larger. Splices shall be solderless pressure connectors with insulating covers for copper conductors #6 AWG and smaller. Aluminum conductors (where specified) shall employ terminations and splices specifically designed for aluminum conductors.

B. Control Conductors: Termination on saddle-type terminals shall be wired directly with a maximum of two conductors. Termination on screw type terminals shall be made with a maximum of two spade connectors. Splices (where allowed) shall be made with insulated compression type connectors.

C. Instrumentation Signal Conductors (including graphic panel, alarm, low and high level signals): terminations same as for control conductors. Splices allowed at instrumentation terminal boxes only.
D. Except where permitted by the Engineer no splices will be allowed in manholes, handholes or other below grade located boxes.

E. Splices shall not be made in push button control stations, control devices (i.e., pressure switches, flow switches, etc), conduit bodies, etc.

3.04 INSTRUMENTATION CABLES

A. Instrumentation cables shall be installed in rigid steel or rigid aluminum raceways as specified. All circuits shall be installed as twisted pairs. In no case shall a circuit be made up using conductors from different pairs.

B. Terminal blocks shall be provided at all instrument cable junction and all circuits shall be identified at such junctions.

C. Shielded instrumentation wire, coaxial, data highway, I/O and fiber optic cables shall be run without splices between instruments, terminal boxes, or panels.

D. Shields shall be grounded as recommended by the instrument manufacturer and isolated at all other locations. Terminal blocks shall be provided for inter-connecting shield drain wires at all junction boxes. Where individual circuit shielding is required, each shield circuit shall be provided with its own block.

E. Seal openings in slabs and walls through which wires and cables pass.

3.05 FIELD TESTING

A. Test all 600 Volt wire insulation with a megohm meter after installation. Make tests at not less than 500 Volt. Submit a written test report of the results to the Engineer.

END OF SECTION
SECTION 16141
WIRING DEVICES

PART 1 - GENERAL

1.01 SCOPE OF WORK
A. Furnish all labor, materials, equipment and install wiring devices as shown on the Drawings and as specified herein.
B. Provide all interconnecting conduit and branch circuit wiring for receptacle circuits in accordance with the NEC.

1.02 RELATED WORK
A. Outlet boxes are included in Section 16110.

1.03 SUBMITTALS
A. Submit, in accordance with Section 01330, detailed catalog information or drawings describing electrical and physical characteristics of all equipment specified in sufficient detail to show compliance with the Drawings and Specifications.

1.04 REFERENCE STANDARDS
A. Wiring devices shall comply with the requirements of the National Electric Code (NEC) and shall be Underwriters Laboratories (UL) labeled.

PART 2 - PRODUCTS

2.01 MATERIALS
A. Wall switches shall be heavy duty, specification grade, toggle action, flush mounting quiet type. All switches shall conform to the latest revision of Federal Specification WS 896. Wall switches shall be of the following types and manufacturer:
   2. Three way, 20 Amp, 120/277 Volt - Arrow-Hart, Catalog No. 1993, similar by Harvey Hubbell, Inc.; Pass & Seymour, Inc. or equal.
   3. Four way, 20 Amp, 120/277 Volt - Arrow-Hart, Catalog No. 1994, similar by Harvey Hubbell, Inc.; Pass & Seymour, Inc. or equal.
B. Receptacles shall be heavy duty, specification grade of the following types and manufacturer or equal. Receptacles shall conform to Fed Spec WC596-F.
1. Duplex, 20 Amp, 125 Volt, 2 Pole, 3 Wire; Arrow-Hart, Catalog No. 5362, similar by Harvey Hubbell, Inc.; Pass & Seymour, Inc. or equal.

2. Weatherproof/corrosion resistant single, 20 Amp, 125 Volt, 2 Pole, 3 Wire, with in-use cast metal cover; Hubbell WP7D or equal.

3. Ground fault interrupter, duplex, 20 Amp, 125 Volt, 2 Pole, 3 Wire, GFCI feed thru type with "test" and "reset" buttons. Arrow-Hart, Catalog No. GF5342, similar by Harvey Hubbell, Inc.; Pass & Seymour, Inc. or equal.

4. Clock hanger single, 15 Amp, 125 Volt, 2 Pole, 3 Wire, with hanging hook on device plate. Arrow-Hart, Catalog No. 452, similar by Harvey Hubbell, Inc.; Pass & Seymour Inc. or equal.

5. Ground fault interrupter, duplex, 20 Amp, 125 Volt, 2 Pole, 3 Wire; Arrow-Hart, Catalog No. 5362, similar by Harvey Hubbell, Inc.; Pass & Seymour, Inc. or equal.

6. Single twist-lock, 20 Amp, 125 Volt, 2 Pole, 3 Wire; Arrow-Hart, Catalog No. 6320; plug: Arrow-Hart, Catalog No. 6322, similar by Harvey Hubbell, Inc.; Pass & Seymour, Inc. or equal.

E. Device Plates

1. Plates for indoor flush mounted devices shall be of the required number of gangs for the application involved and shall be as follows:
   a. Office type areas: Smooth, high impact nylon of the same manufacturer and color as the device. Final color to be as selected by the Architect.

2. Plates for indoor surface mounted device boxes shall be cast metal of the same material as the box, Crouse-Hinds No. DS23G and DS32G, or equal.

3. Oversized plates shall be installed where standard plates do not fully cover the wall opening.

4. Device plates for switches mounted outdoors or indicated as weatherproof shall be gasketed, cast aluminum with provisions for padlocking switches "On" and "Off", Crouse Hinds No. DS185, or equal.

5. Multiple surface mounted devices shall be ganged in a single, common box and provided with an adapter, if necessary, to allow mounting of single gang device plates on multigang cast boxes.

6. Engraved device plates shall be provided where required.

7. Weatherproof, gasketed cover for GFI receptacle mounted in a FS/FD box shall be Hubbell, Catalog No. WP7D, similar by; Pass & Seymour, Inc. or equal.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Switch and receptacles outlets shall be installed flush with the finished wall surfaces in areas with stud frame and gypsum board construction, in dry areas with cement block construction or when raceways are shown as concealed on the Drawings.
B. Do not install flush mounted devices in areas designated DAMP, WET or WET/CORROSIVE on the Drawings. Provide surface mounted devices in these areas.

C. Provide weatherproof devices covers in areas designated WET or WET/CORROSIVE on the Drawings.

D. Convenience outlets shall be 12-in above the floor unless otherwise required.

E. Convenience outlets installed outdoors and in rooms where equipment may be hosed down shall be 18-in above floor or grade.

F. The location of all devices is shown, in general, on the Drawings and may be varied within reasonable limits so as to avoid any piping or other obstruction without extra cost, subject to the approval of the Owner. Coordinate the installation of the devices for piping and equipment clearance.

END OF SECTION
SECTION 16191
MISCELLANEOUS EQUIPMENT

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. Furnish and install all miscellaneous equipment as shown on the Drawings and as specified herein.

1.02 EQUIPMENT LIST

A. This Section provides the requirements for miscellaneous equipment typically employed in a facility, however, not all components specified in this Section are necessarily utilized on this project.

1.03 SUBMITTALS

A. Submit, in accordance with Section 01330, detailed catalog information or drawings describing electrical and physical characteristics of all equipment specified in sufficient detail to show compliance with the Drawings and Specifications.

1.04 REFERENCE STANDARDS

A. Equipment enclosures shall have NEMA ratings suitable for the location in which they are installed, as specified in Section 16000.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Disconnect Switches

1. Disconnect switches shall be heavy-duty, quick-make, quick-break, visible blades, 600 Volt, 3 Pole with full cover interlock, interlock defeat and flange mounted operating handle. All current carrying parts shall be copper.

2. NEMA 4 enclosures shall be stainless steel.

3. NEMA 4X enclosures shall be stainless steel.

4. Switches shall be as manufactured by the Square D Co.; General Electric; Cutler-Hammer, or equal.

B. Fused Disconnect Switches

1. Fused disconnect switches shall be heavy-duty, quick-make, quick-break, visible blades, 600 Volt, 3 Pole with full cover interlock, interlock defeat and flange mounted operating handle. All current carrying parts shall be copper.
2. Fuses shall be rejection type, 600 Volts, 200,000 A.I.C., dual element, time delay, Bussman Fusetron, Class RK-5 or equal.

3. NEMA 4 enclosures shall be stainless steel.

4. NEMA 4X enclosures shall be stainless steel.

5. Switches shall be as manufactured by the Square D Co.; General Electric; Cutler-Hammer, or equal.

C. Horsepower Rated, Toggle Switch Type Disconnect Switch

1. Toggle type disconnect switches shall be manufactured of thermoplastic materials with screw-type terminals. The switches shall be rated 600 VAC and 20A at 600 VAC.

2. Toggle type disconnect switches shall be similar to a manual non-reversing starter without overloads and shall be 3 Pole, capable of “on-off” control of a 10 horsepower motor at 460 VAC.

3. Enclosure shall be provided with lock off provisions.

4. NEMA 4 enclosures shall be die-cast zinc.

5. Switches shall be as manufactured by the Square D Co.; Siemens Electrical Products; Cutler-Hammer or equal.

D. Manual Motor Starters

1. Manual starters shall be suitable for the voltage and number of phase shown on the Drawings and shall be non-reversing, reversing or two speed type as shown on the Drawings. NEMA sizes shall be as required for the horsepowers shown on the Drawings. Manual starters shall have motor overload protection in each phase. Built-in control stations shall be furnished as required or as shown on the Drawings.

2. NEMA 4 enclosures shall be stainless steel.

3. NEMA 4X enclosures shall be stainless steel.

4. Manual motor starters shall be as manufactured by the Square D Co.; General Electric; Cutler-Hammer, or equal.

E. Magnetic Motor Starters

1. Motor starters shall be 2 or 3 Pole, single or 3 Phase as required, 60 Hz, 600 Volt, magnetically operated, full voltage non-reversing except as shown on the Drawings. NEMA sizes shall be as required for the horsepowers shown on the Drawings. Minimum size shall be NEMA size 1.

2. Each motor starter shall have a 120 Volt operating coil, and control power transformer. Starters shall have motor overload protection in each phase. Auxiliary
contacts shall be provided as shown on the Drawings. A minimum of one N.O. and one N.C. auxiliary contacts shall be provided in addition to the contacts shown on the Drawings.

3. Overload relays shall be adjustable, ambient compensated and manually reset.

4. Control power transformers shall be sized for additional load where required. Transformer primaries and secondaries shall be equipped with time-delay fuses.

6. Built-in control stations and indicating lights shall be furnished where shown on the Drawings.

7. NEMA 4 enclosures shall be stainless steel.

8. NEMA 4X enclosures shall be stainless steel.

9. Magnetic motor starters shall be as manufactured by the Square D Co.; General Electric; Cutler-Hammer or equal.

F. Combination Magnetic Motor Starters

1. Motor starters shall be a combination unfused disconnect switch and contactor, 2 or 3 Pole, single or 3 Phase as required, 60 Hz, 600 Volt, magnetically operated, full voltage non-reversing where shown on the Drawings. NEMA sizes shall be as required for the horsepowers shown on the Drawings. Disconnect switches shall be quick-make, quick-break with operating mechanism mounted on a fixed portion of the enclosure. Door mounted mechanisms will not be acceptable.

2. Each motor starter shall have a 120 Volt operating coil and control power transformer. Transformer primaries and secondaries shall be equipped with time-delay fuses. Three phase starters shall have three overload relays. One normally open and one normally closed auxiliary contact shall be provided as spares in addition to contacts shown on the Drawings.

3. Overload relays shall be adjustable, ambient compensated and manually reset.

4. Furnish built-in control stations and indicating lights where shown on the Drawings.

5. NEMA 4 enclosures shall be stainless steel.

6. NEMA 4X enclosures shall be stainless steel.

7. Combination magnetic motor starters shall be as manufactured by the Square D Co.; General Electric; Cutler-Hammer, or equal.

8. Combination contactors shall be as manufactured by the Square D Co.; General Electric; Cutler-Hammer, or equal.

H. Control Stations
1. Control stations shall be heavy-duty type, with full size (30mm) operators. Stop buttons shall have a lockout latch that can be padlocked in the open position.

2. NEMA 4 enclosures shall be stainless steel.

3. NEMA 4X enclosures shall be stainless steel.

4. Control stations shall be Square D Class 9001, similar by Cutler-Hammer; General Electric Co., or equal.

I. General Purpose Dry Type Transformers

1. Transformers shall be dry type, two-winding with kVA and voltage ratings as shown on the Drawings. Transformer shall incorporate a 220 degree C insulation system and be designed not to exceed 115 degrees C temperature rise above a 40 degree C ambient full load.

2. Four full capacity taps shall be furnished, two 2-1/2 percent above and two 2-1/2 percent below rated primary voltage.

3. Windings shall be copper.

4. Transformers shall be built in accordance with ANSI C89.2 and NEMA ST-20 shall be UL listed and suitable for non-sinusoidal current loads with a K-factor of 4.

5. Transformers, other than K-rated units, shall meet the efficiency levels contained in Tables 4.1 and 4.2 of NEMA Standard TP1-1996 and shall contain an EPA “Energy Star” label. Efficiency shall be tested in accordance with TP1-1996.

6. Transformers shall be furnished in NEMA 3R enclosures unless otherwise noted on the Drawings or as required by Section 16000. Areas where a NEMA 4X and/or stainless steel enclosure is required, the transformer shall be of the TENV type.

7. Transformers shall be furnished with hot-dipped galvanized mounting hardware. In NEMA 4X areas or where stainless steel enclosures are required, hardware shall be Type 316 stainless steel. Fasteners shall be Type 316 stainless steel.

8. Transformers shall have common core construction with low hysteresis and eddy current losses. The core flux density shall be below the saturation point to prevent overheating caused by harmonic distortion.

9. Transformer impedance shall be a minimum of 3 percent and a maximum of 5 percent.

10. The neutral bus shall be sized and configured for 200 percent of secondary full load current.

11. Transformers shall be manufactured by Sq D, General Electric Co.; Cutler-Hammer, or equal.
N. Wireway

1. NEMA 1 wireway shall be painted steel with screw covers.

2. NEMA 4 and 4X wireway shall be stainless steel with gasketed screw covers and stainless steel screws.

3. NEMA 1 wireway shall be Square-Duct as manufactured by the Square D Co.; NEMA 4 and 4X shall be Bulletin F-22 as manufactured by the Hoffman Engineering Co.; Appleton; Killark, or equal.

P. Control Relays

1. Control relays shall be heavy duty machine tool type, with 10 Amp, 300 Volt convertible contacts. Number of contacts and coil voltage shall be as shown on the Drawings. General use relays shall be General Electric Co., Catalog No. CR120B; similar by Square D Co.; Allen-Bradley Co., or equal. Latching relays shall be General Electric Co., Catalog No. CR120BL; similar by Square D Co.; Allen-Bradley Co., or equal.

2. Time delay relays shall be pneumatic, 600 Volt, 20 Amp contacts, with calibrated knob operated adjustment. On delay and off delay types and timing ranges shall be as shown on the Drawings. Relays shall be Agastat Model 7012 or 7022; similar by Square D Co.; Cutler-Hammer, or equal.

Q. Terminal Blocks

1. Terminal blocks shall be NEMA type rated at 20 amperes minimum, 600 Volt, channel mounted, with tubular screw and pressure plate.

2. Terminal blocks shall be Bulletin 1492 as manufactured by the Allen-Bradley Co.; ABB; Kukla, or equal.

R. Emergency Shower Alarm Horn and Light

1. Emergency shower alarm horn shall be vibrating type for 120 Volts, 60 Hz and shall be Federal Signal Corp., Catalog No. 350+WB for surface mounting, Catalog No. 350+FG+FB for flush mounting; Edwards Co., Catalog No. 876-N5 for surface mounting, Catalog No. 870-N5 for flush mounting; Benjamin, Catalog No. ABX for surface mounting, Catalog No. ABY for flush mounting, or equal.

2. Emergency shower alarm light shall be a flashing strobe unit with red fresnel globe, for use on a 120 Volts, 60 Hz power supply, and shall be Benjamin Catalog No. KL-4011-120; similar by Federal Signal, Catalog No. 371 DSTLWMB2; Edwards Co., Catalog No. 90R-N5, or equal.

3. A complete Alarm, Horn and Light unit may be substituted as manufactured by HAWS Co. Model No. 9001.5. Coordinate materials and installation with Division 15.

S. Photocells
1. The photocells shall be suitable for power duty with individual fixtures or for pilot duty with contactors as detailed on the Drawings. Enclosure shall be NEMA 4. Contacts shall be rated for 2,000 watts continuous at 120 Volts. The unit shall turn on at 1.5 footcandles and off at 5.5 footcandles.

2. Photocells shall be Tork, Model 2101; Crouse Hinds T7925 or equal.

3. Unless otherwise specified, time switches shall be as manufactured by Intermatic; TORK.

T. Equipment Identification Nameplates

1. All field mounted electrical equipment such as disconnects, push button stations, etc, shall be provided with a weather resistant engraved laminoid equipment identification nameplate screwed or bolted adjacent to the device. Nameplate shall identify the mechanical equipment controlled exactly as shown on the electrical one line drawings (i.e, (HIGH SERVICE PUMP NO.1 HSP-1).

U. Equipment Mounting Stands

1. Equipment mounting stands shall be custom fabricated from 1/4-in steel plate and 4-in hot dipped galvanized steel channel, as shown on the Drawings. For NEMA 4X areas or where stainless steel enclosures are required mounting stands and channels shall be Type 316 stainless steel.

V. Lighting Contactor

1. Lighting contactor shall be of the electrically operated, mechanically held type mounted in NEMA 4, enclosures (except where noted otherwise on the Drawings) with number of poles as noted on the Drawings. Operating coils shall be rated for 120 Volts unless otherwise indicated on the Drawings and shall be for momentary operation. Provide with "Hand Off-Auto" switch on cover where shown on the Drawings.

2. Contactors shall be rated for 20 Amps, 600 VAC and shall be by Square D Co.; Cutler-Hammer, or equal.

W. Beacon Alarm Light

1. Beacon alarm light for building exterior mounting shall be flush mounted, weatherproof construction and have a 750,000 candlepower xenon strobe tube and red polycarbonate lens. Beacon alarm light shall be Federal Signal, Model 371 DST; similar by Edwards; Wheelock, or equal.

X. Rubber Floor Mats

1. Furnish and install a non-conductive elastomer compound rubber floor mat extending the full length and placed in front of each motor control center panelboards and separately mounted motor starters mounted 6-ft above finished floor or below.
2. Mats shall be in accordance with ASTM D178 specification, Type II, Class 2, 1/4-in thick minimum, 36-in wide with corrugated surface and shall be branded continuously on the back.

3. Mats shall have the following ratings:
   a. Voltage phase to phase 17,000 V RMS
   b. AC Proof Test Voltage 20,000 V RMS
   c. DC Proof Test Voltage 50,000 V Average

4. Type II mats shall be ozone, flame and oil resistant.

5. Install mats in one continuous piece. Where equipment faces each other and is less than 6-ft apart, provide one width of mat.

6. Mats shall be stored without distortion, free from direct sun light or sources of ozone and at a temperature not to exceed 95 degrees F (35 degrees C).

Y. Arc Flash Protection Warning Signs

1. Provide field-affixed arc flash warning labels on all switchboards, panelboards, industrial control panels, and motor control centers in accordance with National Electrical Code Article 110.16.

2. As a minimum, warning signs shall state “WARNING: Arc Flash and Shock Hazard, Appropriate PPE required”, and shall be designed in accordance with ANSI Z535.4-1998. Where available from the equipment manufacturer, additional information including Flash Hazard boundary, incident energy, voltage shock hazard, PPE required, etc. shall be provided.

3. The specific additional information that should be added to the label includes.
   b. Flash protection Boundary.
   c. Incident energy at 18 inches expressed in cal/cm2.
   d. PPE required.
   e. Voltage shock hazard.
   f. Restricted shock approach boundary.
   g. Prohibited shock approach boundary.

Z. Electric Warning Sign and Safety Signs

2. **Wording:** “DANGER – ELECTRICAL EQUIPMENT, AUTHORIZED PERSONNEL ONLY”  
   **Location:** On the outside door of all electrical equipment rooms or areas. On the outside door of all electrical equipment cabinets.

3. **Wording:** “DANGER – POWERED FROM MORE THAN ONE SOURCE”  
   **Location:** Outside all equipment that operates from more than one power source; ATS, PLCs, Main Tie Main switchgear/MCCs, etc.

4. **Wording:** “NOTICE – KEEP DOOR CLOSED”  
   **Location:** On all doors with another safety sign installed.

5. **Wording:** “CAUTION – CONTROLS & INTERLOCKS POWERED FROM MULTIPLE SOURCES”  
   **Location:** On all control panel doors, MCCs, I&C terminal cabinets, etc.

**PART 3 - EXECUTION**

3.01 **INSTALLATION**

A. **Mounting Stands**

1. Field mounted disconnects, pushbutton control stations, alarm panels, enclosed starters and circuit breakers, transformers, automatic transfer switches, wireways, contactors, terminal boxes, junction and pull boxes shall be mounted on stainless steel stands as specified. Where clearance requirements for stands may not be maintained, the Engineer may direct electric control equipment to be wall-mounted adjacent to the driven equipment, but in no case shall the distance from the drive motor to the control station exceed 3-ft, all at no additional cost to the Owner.

2. All floor mounting stands, bracing, anchor bolts and appurtenances furnished to support equipment loads, shall conform to the latest applicable requirements of the State Building Code in effect at the time of Bid.

3. All wall mounted brackets, bracing, bolts and appurtenances to support equipment loads dynamic loads, wind loads and seismic forces shall conform to the latest applicable requirements of the State Building Code in effect at the time of Bid.

4. Channel supports shall be ground smooth and fitted with plastic end caps.

3.02 **FIELD TESTING**

A. Before supplying power to the control panels, the following tests shall be done: Verify that all wiring connection interfaces that are required are present. Check for secure connections. Using a continuity device, verify that all discrete inputs and output to and from the control panel are wired in correct polarity and are operating in the correct state of operation (normally open or closed state). Check for any direct short circuits across all voltage supply sources. As each of the above tests are performed, the Electrical Contractor shall highlight and initial each circuit that is tested. This set of prints shall be signed and left inside the enclosure.

B. Check mechanical interlocks for intended operation. Make any adjustments required.
C. In the event of an equipment fault in the panel, notify the Engineer immediately. After the cause of the fault has been identified and corrected, a joint inspection of the equipment shall be conducted by the Contractor and Engineer. Repair or replace the equipment as directed by the Engineer prior to placing the equipment back into service at no additional cost to the Owner.

END OF SECTION
SECTION 16470

PANELBOARDS

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor, materials, equipment and incidentals required and install all panelboards as shown on the Drawings and as specified herein.

1.02 SUBMITTALS

A. Submit, in accordance with Section 01330, detailed catalog information or drawings describing electrical and physical characteristics of all equipment specified in sufficient detail to show compliance with the Drawings and Specifications.

1.03 REFERENCE STANDARDS

A. Panelboards shall be in accordance with the Underwriter Laboratories (UL) "Standard for Panelboards" and "Standard for Cabinets and Boxes" and shall be so labeled where procedures exist. Panelboards shall also comply with NEMA Standard for Panelboards and the National Electrical Code (NEC).

B. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

1.04 MANUFACTURERS

A. 120/208 Volt, 3 Phase, 4 Wire panelboards shall be Type NQ as manufactured by Square D Co.

B. 277/480 Volt, 3 Phase, 4 Wire panelboards shall be Type NF as manufactured by Square D Co.

PART 2 - PRODUCTS

2.01 GENERAL

A. Rating

1. Panelboard ratings shall be as shown on the Drawings. All panelboards shall be rated for the intended voltage.

2. Circuit breaker panelboards shall be fully rated for the specified circuit breaker fault current interrupting capacity. Series connected short circuit ratings will not be acceptable.
2.02 MATERIALS (NEMA 1)

A. Interiors

1. All interiors shall be completely factory assembled with circuit breakers, wire connectors, etc. All wire connectors, except screw terminals, shall be of the anti-turn solderless type and all shall be suitable for copper or aluminum wire of the sizes indicated.

2. Interiors shall be so designed that circuit breakers can be replaced without disturbing adjacent units and without removing the main bus connectors and shall be so designed that circuits may be changed without machining, drilling or tapping.

3. Branch circuits shall be arranged using double row construction except when narrow column panels are indicated. Branch circuits shall be numbered by the manufacturer.

4. A nameplate shall be provided listing manufacturer's name, panel type and rating.

B. Buses

1. Bus bars for the mains shall be of copper. Full size neutral bars shall be included. Phase bussing shall be full height without reduction. Cross connectors shall be copper.

2. Neutral bussing shall have a suitable lug for each outgoing feeder requiring a neutral connection.

3. Spaces for future circuit breakers shall be bussed for the maximum device that can be fitted into them.

4. Equipment ground bars shall be furnished.

C. Boxes

1. Recessed or flush mounted boxes shall be made from galvanized code gauge steel having multiple knockouts, unless otherwise noted. Boxes shall be of sufficient size to provide a minimum gutter space of 4-in on all sides.

2. Surface mounted boxes and trims shall have an internal and external finish as specified in Paragraph 2.04D4 below. Surface mounted boxes shall be field punched for conduit entrances.

3. At least four studs for mounting the panelboard interior shall be furnished.
D. Trim

1. Hinged doors covering all circuit breaker handles shall be included in all panel trims.

2. Doors shall have semi flush type cylinder lock and catch, except that doors over 48-in in height shall have a vault handle and 3-point catch, complete with lock, arranged to fasten door at top, bottom and center. Door hinges shall be concealed. Furnish two keys for each lock. All locks shall be keyed alike; directory frame and card having a transparent cover shall be furnished on each door.

3. The trims shall be fabricated from code gauge sheet steel.

4. All exterior and interior steel surfaces of the panelboard shall be properly cleaned and finished with ANSI Z55.1, No. 61 light gray paint over a rust-inhibiting phosphatized coating. The finish paint shall be of a type to which field applied paint will adhere.

5. Trims for flush panels shall overlap the box by at least 3/4-in all around. Surface trims shall have the same width and height as the box. Trims shall be fastened with quarter turn clamps.

2.03 MATERIALS (NEMA 3, 4 and 12)

A. Interiors and Buses

1. Interiors and buses shall be as hereinbefore specified for NEMA 1 construction.

B. Boxes and Covers

1. Boxes and covers shall be made from stainless steel with natural finish.

2. Boxes and covers shall be bolted together and gasketed.

3. Conduit openings shall be tapped.

2.04 CIRCUIT BREAKERS

A. Panelboards shall be equipped with circuit breakers with frame size and trip settings as shown on the Drawings.

B. Circuit breakers shall be molded case, bolt-on type. Plug in type are not acceptable.

C. Each circuit breaker used in 120/208 Volt panelboards shall have an interrupting capacity of not less than 22,000 Amps AIC.

D. GFCI (ground fault circuit interrupter) shall be provided for circuits where shown on the Drawings. GFCI units shall be 1 Pole, 120 Volt, molded case, bolt-on breakers, incorporating a solid state ground fault interrupter circuit insulated and isolated from the
breaker mechanism. The unit shall be UL listed Class A Group I device (5 milliamp sensitivity, 25 millisecond trip time) and an interrupting capacity of 65,000 Amps, RMS.

E. Circuit breakers shall be as manufactured by the panelboard manufacturer.

PART 3 - EXECUTION

3.02 INSTALLATION

A. Mount boxes for surface mounted panelboards so there is at least 1/2-in air space between the box and the wall.

B. Connect panelboard branch circuit loads so that the load is distributed as equally as possible between the phase busses.

C. ‘Final’ Circuit directories shall be neatly typed giving location and nature of load served. Install circuit directories in a clear vinyl sleeve for each panelboard. Submit to engineer for final approval.

D. Install markers on the front cover of all panelboards which identify the voltage rating. Markers shall be made of self sticking B-500 vinyl cloth printed with black characters on an Alert Orange background, 2-1/4-in high by 9-in wide, Style A as manufactured by W.H. Brady Co. or equal.

E. Install a 1-in by 3-in laminated plastic nameplate with 1/4-in black letters on a white background on each panelboard. Nameplate lettering shall be as shown on the Drawings. Nameplates shall be stainless steel screw mounted.

END OF SECTION
SECTION 16500
LIGHTING SYSTEM

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor, materials, equipment and incidentals required and install a complete lighting system ready for operation as shown on the Drawings and as specified herein.

1.02 RELATED WORK

A. All concrete and reinforcing steel required for exterior lighting pole bases shall be as specified under Division 3, but the responsibility of furnishing and installing the material shall be that of Division 16.

B. Conduit is included in Section 16110.

C. Wire is included in Section 16120.

D. Transformers are included in Section 16191.

E. Photo-electric controls and contactors are included in Section 16191.

F. Panelboards are included in Section 16470.

1.03 SUBMITTALS

A. Submit, in accordance with Section 01330, detailed catalog information or drawings describing electrical and physical characteristics of all equipment specified in sufficient detail to show compliance with the Drawings and Specifications.

1.04 REFERENCE STANDARDS

A. All lighting fixtures shall be in accordance with the National Electrical Code (NEC) and shall be constructed in accordance with the latest edition of the Underwriters Laboratories (UL) "Standards for Safety, Electric Lighting Fixtures." All lighting fixtures shall be UL labeled.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Lighting Fixtures

1. Lighting fixture types shall be furnished as required by the "Lighting Fixture Schedule" on the Drawings. The catalog numbers are given as a guide to the
design and quality of fixture desired. Equivalent designs and equal quality fixtures of other manufacturers will be acceptable upon approval by the Engineer.

B. Lamps

1. Fluorescent lamps shall be medium bi-pin, recessed, double contact, rapid start, tri-phosphor, 4100 Kelvin and compact types all as shown on the "Fixture Schedule".

2. H.I.D. lamps shall as specified in the "Lighting Fixture Schedule".

5. Incandescent lamps shall be inside frosted, halogen, 2500 hour minimum life with medium base.

6. All lamps shall be of one manufacturer and shall be as manufactured by Osram/Sylvania Electric Products, Inc.; General Electric Co.; North American Philips Lighting Corp. or equal.

C. Ballasts

1. Fluorescent ballasts shall be electronic, high-frequency, full-output rapid-start type for use on 265 mA, T8 lamps.

   a. All ballasts shall be UL listed, ETL certified, Class "P", high power factor (minimum 0.90).

   b. Ballasts shall have a "A" sound rating or better.

   c. All ballasts used in exterior applications shall have a minimum starting temperature of 0 degrees F unless otherwise specified.

   d. All interior ballasts shall have a minimum starting temperature of 50 degrees F.

   e. Ballasts shall be series wired type and designed to operate the number and length of lamps specified.

   f. The total harmonic distortion (THD) of each ballast shall be in accordance with the requirements of the utility company and in no case shall it be less than 10 percent THD.

   g. Ballasts shall have a minimum ballast factor of 0.88.

   h. Ballasts shall have nominal power factor 0.90 or higher.

   i. Ballasts shall have a maximum lamp current crest factor of 1.7.

   j. Ballast shall provide normal rated life for the lamp specified.

   k. All electronic ballasts shall be warranted for parts and replacement for 1 full year from the date of installation.

   l. Electronic ballasts shall be as manufactured by Advance, Model Mark V, similar by Valmont; Osram/Sylvania; MagneTek or equal.
j. H.I.D. ballasts shall be of the type of the correct size and voltage for the fixture it
is to serve as shown on the "Lighting Fixture Schedule". All ballasts shall be as
manufactured by MagneTek Universal Manufacturing; Advance Transformer
Co. or equal.

D. Flexible Fixture Hangers

1. Flexible fixture hangers used in non-hazardous areas shall be type ARB and
flexible fixture supports used in hazardous areas shall be Type ECHF as
manufactured by the Crouse-Hinds Co., similar by Appleton Electric Co.; Killark
Electrical Mfg. Co. or equal.

2. Where required in Section 16000 all pendent mounted and recessed in suspended
ceilings, recessed lighting fixtures shall be provided with four anti-sway supports to
meet Type II seismic requirements.

E. Emergency Lighting Battery Units

1. Emergency lighting units and remote lighting heads shall be as specified in the
"Lighting Fixture Schedule" shown on the Drawings.

2. Battery units shall be of the self-contained, fully automatic type with sealed lead
acid batteries, volt-meters and time delay relays where used in H.I.D. lighted areas.

3. Unit enclosures shall be compatible to their environment and units shall comply
with the requirements of NFPA 70 (NEC).

4. All necessary mounting hardware shall be provided.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Each fixture shall be a completely finished unit with all components, mounting and/or
hanging devices necessary, for the proper installation of the particular fixture in its
designated location and shall be completely wired ready for connection to the branch
circuit wires at the outlet.

B. All flush mounted fixtures shall be supported from the structure and shall not be
dependent on the hung ceilings for their support.

C. Fixtures noted to be installed flush in suspended ceilings shall be of mounting types
suited for the type ceiling involved. It shall be the responsibility of the electrical
contractor to verify the ceiling types prior to ordering fixtures.

D. Flexible fixture hangers shall be used for all pendant mounted fixtures. Fixtures 2-ft
long and larger shall be supported with a minimum of two fixture hangers.

E. Conduit run in areas with hung ceilings shall be installed in the space above the hung
ceiling as close to the structure as possible. Conduits shall be supported from the
structure.
F. Exterior lighting poles shall be mounted plumb.

G. Fixture locations are shown on the Drawings in approximate locations; however exact locations shall be coordinated so as to avoid conflicts with HVAC ducts, equipment and other obstacles.

3.02 REPLACEMENT

A. Lamps (except for H.I.D.) used during the building construction, prior to 2 weeks from completion of the work, shall be removed and replaced with new lamps.

3.03 CLEANING UP

A. Plastic dust cover bags to be provided with new parabolic reflector lighting fixtures shall be removed after all construction activity that may cause dust formation on reflector surfaces has been completed.

B. All fixtures shall be left in a clean condition, free of dirt and defects, before acceptance by the Engineer.

END OF SECTION
PART 1 – GENERAL

1.01 SCOPE OF WORK

A. Provide a complete lightning protection system for the Port of the Islands proposed Reverse Osmosis water treatment plant. The system shall be UL labeled and shall be designed and installed in compliance with provisions of UL-96A and NFPA-780.

B. The lightning protection system shall be checked by a UL field inspector upon completion of the installation. Assume full responsibility for the correctness of the installation and shall make any and all corrections and additions deemed necessary by the UL inspector. Pay for all costs of the UL inspection and any subsequent reinspections as required.

C. The lightning protection system for the building shall consist of an aluminum ground wire with air terminals which shall be grounded to the building structural steel or ground grid at regular intervals. The Contractor has the option of submitting alternate methods of lightning protection for consideration in his/her Proposal, provided they offer an equal or greater degree of protection than those specified.

D. The grounding systems for the building shall be provided under Section 16660.

1.02 SUBMITTALS

A. Submit, in accordance with Section 01330, the manufacturers’ names and product designation or catalog numbers with marked cut sheets of all materials specified.

1.03 REFERENCE STANDARDS

A. Underwriters Laboratories (UL)

1. UL 96A - UL Standard for Safety Installation Requirements for Lightning Protection System.

B. National Fire Protection Association (NFPA)

1. NFPA 780 - Lightning Protection Code

C. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.
PART 2 – PRODUCTS

2.01 MATERIALS

A. All materials shall be new and shall comply in weight, size and composition with the requirements of UL and NFPA.

B. Grounding materials and methods shall be equal to those specified under Section 16660.

C. The following is a brief description of the various items of material:

1. Air Terminals
   a. Air terminals shall be 1/2-in by 12-in minimum solid aluminum and shall extend at least 12-in above the object to be protected. All air terminal bases shall be cast bronze with stainless steel bolt pressure cable connectors. The air terminals should be spaced so as not to exceed 22-ft apart around the outside perimeter of the roof or the ridge and not over 50-ft apart through the center of flat roof areas. The air terminals in the center roof area shall be 5/8-in by 48-in solid aluminum with a proper brace. All air terminal bases for flat roof areas shall be of the adhesive type. Air terminals shall be "lightning Master “ Model No. LM-PP-31A or approved equal.

2. Conductors
   a. Conductors shall consist of UL listed 29 strands 3/8” diameter braided of 17 gauge cu wire weighing 190 lbs per 1000-ft and installed in accordance with the UL Code. Conductors on the flat roof areas may be run exposed. Ground connections shall be made to the main down conductor at a maximum of 60-ft-0-in on centers.

3. Fasteners
   a. Conductor fasteners shall be an approved type of non-corrosive metal, have ample strength to support conductors and shall be spaced not to exceed 3-ft-0-in centers. Masonry type cable fasteners spaced every 3-ft-0-in on masonry. Adhesive type cable fasteners spaced every 3-ft-0-in on flat roofs.

4. Cable Connectors
   a. All cable connectors shall be cast bronze with screw-pressure type stainless steel bolts and nuts.

PART 3 – EXECUTION

3.01 INSTALLATION

A. All materials shall be installed by experienced workmen that specialize in this type of work. The lightning protection system shall be installed per approved shop drawings and UL and NFPA recommended practices.
B. The lightning protection system engineering company shall provide job site assistance and supervision of the installation as required, and shall be present during the UL inspection.

C. All concealed conductors shall be installed in Schedule 40 PVC conduit.

D. All metal bodies within 6-ft of the conductor shall be bonded to the system with approved fittings and conductor. Connections between dissimilar metals shall be made with approved bimetallic connections.

END OF SECTION
SECTION 16660

GROUNDING SYSTEM

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor, materials, equipment and incidentals required and install a complete grounding system in strict accordance with Article 250 of the National Electrical Code 2008 (NEC), as shown on the Drawings and as specified herein.

B. All raceways, conduits, ducts and multi-conductor cables shall contain equipment grounding conductors sized in accordance with the NEC. Minimum sizes shall be No. 12 AWG.

C. A supplemental grounding conductor shall be provided from each motor control center, power panelboard, lighting panelboard, motor or process control panel, instrumentation control panel to the buried ground grid system ground loop. Supplemental grounding conductors shall be installed in PVC Schedule 80 conduit. The supplemental grounding conductors for motor control centers shall consist of redundant code sized cables in conduit. Conductors shall be connected to opposite ends of the distribution equipment ground bus.

1.03 SUBMITTALS

A. Submit, in accordance with Section 01330, detailed catalog information or drawings describing electrical and physical characteristics of all equipment specified in sufficient detail to show compliance with the Drawings and Specifications.

1. Manufacturer’s name and catalog data for ground rods, exothermic welding methods, grounding clamps including installation requirements and materials.

B. Submit results of grounding and bonding resistance testing as specified herein

PART 2 - PRODUCTS

2.01 MATERIALS

A. Conduit shall be as specified under Section 16110.

B. Wire shall be as specified under Section 16121.

C. Ground rods shall be 3/4-in by 10-ft copper clad steel and constructed in accordance with UL 467. The minimum copper thickness shall be 0.25 mm. Ground rods shall be Copperweld; Blackburn; Erico, Inc. or equal.
D. Grounding conduit hubs shall be malleable iron type, and of the correct size for the conduit, as manufactured by Thomas & Betts Co.; Catalog No. 3940 Series, similar by Burndy; O.Z. Gedney Co. or equal.

F. Buried grounding connections shall be by Cadweld process, or equal exothermic welding system.

   1. Molds, cartridge materials and accessories shall be provided in kit form and selected per the manufacturer’s written instructions for specific types, sizes and combinations of conductors and connected items. Molds and powder shall be furnished by the same manufacturer.

G. Ground Rod Test Wells

   1. Ground rod test wells shall be complete with cast iron riser ring and traffic cover marked “GROUND ROD”. Boxes and covers shall be suitable for H-20 wheel loading.

   2. Test wells shall be as manufactured by Erico, T416A; Christy Co., No. G5; Lightning and Grounding System, Inc., Series I-R.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install equipment grounding conductors with all feeders and branch circuits.

B. Bond all steel building columns in new structures together with ground wire in rigid conduit and connect to the distribution equipment ground bus, as shown on the Drawings.

C. Ground wire connections to structural steel columns shall be made with exothermic welds.

D. Metal conduits stubbed into a motor control center or floor mounted electrical enclosure shall be terminated with insulated grounding bushings and connected to the motor control center or electrical enclosure ground bus. Bond boxes mounted below motor control centers to the motor control center ground bus. Size the grounding wire in accordance with [NEC] Table 250-122, except that a minimum No. 12 AWG shall be used.

E. Liquid tight flexible metal conduit in sizes 1-1/2-in and larger shall have bonding jumpers. Bonding jumpers shall be external, run parallel (not spiraled) and fastened with plastic tie wraps.

F. Ground transformer neutrals to the nearest available grounding electrode with a conductor sized in accordance with [NEC] [MEC] Article 250-66.

G. Drive grounding electrodes as shown on the Drawings.

H. All equipment enclosures, motor and transformer frames, conduits systems, cable armor, exposed structural steel and all other equipment and materials required by the [NEC] to be grounded, shall be grounded and bonded in accordance with the [NEC].
I. Seal exposed connections between different metals with No-Oxide Paint Grade A or equal.

J. Lay all underground grounding conductors slack and, where exposed to mechanical injury, protect by pipes or other substantial guards. If guards are iron pipe, or other magnetic material, electrically connect conductors to both ends of the guard. Make connections as specified herein.

K. Care shall be taken to ensure good ground continuity, in particular between the conduit system and equipment frames and enclosures. Where necessary, jumper wires shall be installed.

L. All grounding type receptacles shall be grounded to the outlet boxes with a No. 12 THW green conductor connected to the ground terminal of the receptacle and fastened to the outlet box by means of a grounding screw.

M. Molds used for welding shall be new. The number of welds made per mold shall not exceed manufacturer's recommendations.

N. Ground metal poles supporting outdoor lighting fixtures to a supplemental grounding electrode (rod) in addition to the separate equipment grounding conductor run with the supply branch circuit.

O. Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with ground clamp connectors.

P. Bond interior metal piping systems and metal air ducts to equipment grounding conductors of associated pumps, fans, blowers, electric heaters and HVAC equipment. Use braided-type bonding straps.

Q. Ufer Ground (Concrete-Encased Grounding Electrode): Fabricate in accordance with NEC Paragraph 250.52 using a minimum of 20-ft of bare copper conductor not smaller than No. 4 AWG. Where base of foundation is less than 20-ft in length, coil excess conductor within base of concrete foundation. Extend grounding conductor below grade and connect to building grounding grid, ground loop, or grounding electrode external to concrete.

3.03 INSPECTION AND TESTING

A. Inspect the grounding and bonding system conductors and connections for tightness and proper installation.

B. Use Biddle Direct Reading Earth Resistance Tester or equivalent test instrument to measure resistance to ground of the system. Perform testing in accordance with test instrument manufacturer's recommendations using the fall-of-potential method.

C. All test equipment shall be provided under this Section and approved by the Engineer.

D. Resistance to ground testing shall be performed during dry season. Submit test results in the form of a graph showing the number of points measured (12 minimum) and the numerical resistance to ground.

E. Testing shall be performed before energizing the distribution system.
F. A separate test shall be conducted for each building or system.

G. Test all grounded cases and metal parts associated with the electrical equipment for continuity with the ground system.

H. Submit test results to the Engineer for review.

I. Notify the Engineer immediately if the resistance to ground for any building or system is greater than five ohms.

END OF SECTION
SECTION 17100
FIRE ALARM SYSTEM

PART 1 – GENERAL

1.1 WORK INCLUDES

A. Contractor shall provide:

1. Furnish and install a complete Fire Alarm System as described herein and as shown on the plans. Fire Alarm system to be wired, connected, and left in first class operating condition. The system shall use closed loop initiating device circuits with individual zone supervision, individual indicating appliance circuit supervision, and incoming and standby power supervision. System shall include control panel, remote annunciator panel, manual pull stations, automatic smoke and fire detectors, audible and visual alarm indicating appliances as indicated on drawings, and all wiring, connections to devices, outlet boxes, junction boxes, and all other necessary material for a complete operating system. Any equipment not specifically mentioned in this specification or not shown on the drawings, but required for the operation of this system, shall be furnished and installed.

2. Fire Alarm Control panel connection to sprinkler system flow and tamper devices where shown on drawings.

1.2 OPERATION

A. The operation of any one of the Fire Alarm System manual fire alarm stations or automatic devices shall cause its respective zone to be identified on the main fire alarm control panel (and remote annunciator when provided) and cause the alarm signals to sound on all audible alarm devices and shall cause the visual alarm devices to flash. Operating a silence switch on the main panel shall silence the audible alarm but the visual alarm devices shall continue to flash until system is reset. However, a subsequent alarm from another zone shall automatically re-sound the signals and light the corresponding zone lamp until it is acknowledged. This shall continue until all actuated devices are restored and the system is reset. Systems without the automatic resound feature are not acceptable.

B. In addition, upon the actuation of the alarm devices, the system shall turn off air handling units and close smoke dampers as noted (unless selective zone shutdown is indicated on the drawings), and shall automatically notify the local fire department by means of a city module (and digital communicator when shown). The telephone connection fee for connecting the fire alarm control panel to the local fire department shall be paid by the Owner.

1.3 SUPERVISION- Fire Alarm System

A. The system shall contain the required number of Class “B” independently supervised initiation circuits so that a fault in any one zone shall not affect any other zone. The alarm activation of any initiation circuit shall not prevent the subsequent alarm operation of any other initiation circuit.

B. There shall be the required number of independently supervised and independently fused indicating appliance circuits for audible alarm appliances and visual alarm appliances. Disarrangement conditions of any circuit shall not affect the operation of other circuits.
C. All auxiliary manual controls shall be supervised so that all switches must be returned to the normal automatic position to clear system trouble.

D. Each independently supervised circuit shall include discrete amber "Trouble" LED to indicate disarrangement conditions per circuit.

E. The incoming power to the system shall be supervised so that any power failure must be audibly and visually indicated at the control panel (and the remote annunciator). A green "power on" LED shall be displayed continuously while incoming power is present.

F. The system batteries shall be supervised so that a low battery condition or disconnection of the battery shall be audibly and visually indicated at the control panel (and the remote annunciator).

G. System Modules shall be supervised. Should a module become disconnected, the system trouble indicator must illuminate and audible trouble signal must sound.

H. The system shall be provided with sufficient battery capacity to operate the entire system upon loss of normal 120 VAC power under maximum normal load twenty-four (24) hours with five (5) minutes of alarm operation at the end of this period. The system shall automatically transfer to the standby batteries upon power failure. All battery charging and recharging operations shall be automatic.

I. All circuits requiring system operating power shall be 24 VDC and shall be individually fused at the control panel.

PART 2 – PRODUCTS

2.1. FIRE ALARM SYSTEM CONTROL PANEL

A. Where shown on the drawings provide and install an Addressable Fire Alarm Control Panel. Construction shall be modular with solid state, microprocessor based electronics. All visual indicators shall be high contrast, LED type.

B. The control panel shall contain the following minimum features. Other components shall be furnished as required:

1. Addressable Class “B” Initiation Device Circuits
2. Alarm Indicating Appliance Circuits
3. Supervised Remote Station Connection
4. Earth Ground Supervision Circuit
5. Power Supply module(s)
6. Indicating appliance module(s)
7. Automatic Battery Charger
8. Standby Batteries
9. Supervised Manual Evacuation Switch
11. System shall include network capability and equipment required to interconnect Fire Alarm System Control panel with Fire Alarm System Control panel(s) at other buildings on this site.
12. Any other required modules, relays, hardware, or accessories.
13. In addition, lightning surge protection shall be provided for the incoming 120 volt power supply and all circuits entering and leaving the building.

C. The control panel shall also include the following features and hardware:
1. Lockable front door with visible status. LEDs and primary operator switches. LEDs for "fire alarm", "system supervisory", "system trouble", "alarm silenced", and "A.C. power". Pushbuttons or pressure pads for alarm acknowledge, supervisory acknowledge, trouble acknowledge, alarm silence and system reset.

2.2. FIRE ALARM SYSTEM MANUAL STATIONS

A. Manual Stations shall be non-coded, single action, rated 120 VAC, semi-flush mounted on 4" x 4" x 2-1/8" deep outlet box, equipped with a key-operated test reset lock for testing and resetting purposes. Means shall be provided to identify the manual station which was actuated. All manual stations shall be keyed alike. The station shall be so designed that after actual operation it cannot be restored to normal except by authorized personnel. Station finish color shall be red with white letters.

2.3. FIRE ALARM SYSTEM SMOKE DETECTORS

A. Smoke Detector shall be photoelectric type with base, surface or semi flush mounted on an outlet box, rated 24 VDC, 14° F to 122°F temperature operating range, 10% to 90% RH range.

2.4. HEAT DETECTORS

A. Heat Detectors shall be automatic, rate-of-rise, fixed temperature (135°F). Fixed temperature or fixed temperature and rate-of-rise types with other than above temperature, will be noted on the drawings.

2.5. FIRE ALARM SYSTEM HORNS (AUDIBLE INDICATING APPLIANCE)

A. Horns shall be red, minimum 95 DB at 10', 24 volts D.C., continuously sounding, parallel wired, supervised, semi-flush mounted.

2.6. FIRE ALARM SYSTEM END-OF-LINE RESISTOR

A. End-of-Line Resistor shall be mounted inside the last device (or at the device shown) in the line and shall be of the type required for initiating or indicating circuits.

2.7. FIRE ALARM SYSTEM VISUAL ALARMS (VISUAL INDICATING APPLIANCE)

A. Xenon flasher, clear polycarbonate lens, unsynchronized, flash rate between 1 and 3 hertz. Minimum pulse duration 0.2 sec. with a maximum duty cycle of 40%, 24 volts D.C.

B. When the symbology on the drawing indicates a visual unit at a horn location, it may be combined on the same faceplate (grille) as the horn.

C. Unless otherwise noted in paragraph "D" below or on the drawings, all strobes shall be minimum 75 candela.

D. In corridors, 15 candela strobes may be used. Locate maximum 15' from ends of corridors and maximum 100' between units. Where there is an interruption in the corridor such as a 90° turn (or similar) or cross-corridor doors, or changes in elevation, each section of corridor shall be treated as separate as relates to the above spacing criteria.

E. Strobes shall be mounted to a flush box (except they may be surface mounted in mechanical and electrical equipment areas and similar areas such as telephone rooms).
2.8. FIRE ALARM SYSTEM RELAYS

A. Motor Shutdown relays shall be furnished and installed near the motor starters (within 3’) and shall have 24 VDC coil, electrically held, contact ampere rating as required, NEMA 1 enclosure. Where more than one motor starter (to be shutdown simultaneously) is in close proximity, an equivalent multi-pole relay may be provided to deactivate these starters, provided there is no conflict with any zoned shutdown noted on the drawings.

2.9. WATERFLOW ALARM DEVICES AND SUPERVISORY DEVICES

A. Water flow alarm switches and sprinkler valve supervisory switches for O.S. & Y. gate valves shall be furnished and installed by others and wired by the Contractor.

B. Sprinkler valve supervisory switches shall be connected to sound the supervisory signal and to light an individual supervisory light in the panel via individual zone modules in the fire alarm control panel.

2.10. REMOTE ANNUNCIATOR

A. Serial type, window (matrix) or 80 character LCD type. If matrix type, provide one window for each alarm zone and 4 spare. Equip with audible and visual trouble alarms. Also, provide trouble silence, alarm silence, system reset and manual evacuation switches. The annunciator shall be supervised from the control panel.

2.11. MANUFACTURERS

A. The Fire Alarm System shall be UL listed manufactured by Simplex, Edwards, Firelite, Gamewell, Pyrotronics, Fenwall, or Notifier. All system components and accessories shall be by the same manufacturer.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Install all components in accord with the manufacturer’s instructions and the requirements of NFPA-72.

B. Install area smoke detectors minimum 3’ from supply air diffusers.

C. Install heat or smoke detectors in accordance with their listed spacing.

D. Install all devices flush or semi-flush in a recessed box unless otherwise noted. It is permissible to surface mount devices in mechanical and electrical equipment rooms, machinery spaces, telephone rooms, etc.

E. Detectors shall not be installed until after clean-up of all trades is complete and final. Detectors that have been installed prior to final clean-up by all trades shall be cleaned or replaced prior to turnover.

F. All horns and visual alarms installed in damp or wet locations shall be weatherproof type.

3.02. WIRING AND CONDUIT

A. Wiring shall be NEC type THHN, copper, minimum #14 AWG for alarm indicating appliances
and auxiliary circuits such as relays, fan shutdown, etc. Initiation circuits shall be minimum #18 AWG. Alarm indicating appliance circuits shall be sized larger than #14 where required to compensate for voltage drop.

B. In no case shall wiring of smaller sizes be installed. All wiring shall meet the recommendations of the manufacturer when more stringent than these specifications. In all cases, conform to the minimum requirements of article 760 of the NEC except where these specifications are more stringent.

C. Install all Fire Alarm System wiring in conduit.

D. Wiring installed in hung ceilings shall be installed so as not to prevent removal of ceiling tiles or to deny access to equipment within the ceiling.

E. Final connections to devices and equipment shall be made by or supervised by the manufacturer's representative.

F. The fire alarm wiring and any diagrams are shown as a guide to the Contractor. The actual number of conductors and size of conduit required for the system supplied shall be the responsibility of the Contractor working with the manufacturer's representative. Use shielded wiring and/or separate 120 VAC wiring from 24 VDC wiring in separate conduits as recommended by the system manufacturer.

3.03. TESTING

A. The completed fire alarm system shall be fully tested in accordance with NFPA-72, Chapter 7, by the contractor in the presence of the local fire marshal. Each and every device shall be tested. All circuits shall be tested to be free of opens and grounds. Upon completion of a successful test, the contractor shall so certify in writing to the owner and general contractor and engineer/architect.

3.04. SHOP DRAWINGS

A. Shall include a complete wiring diagram indicating all systems wiring connections from terminal to terminal. The submission of wiring diagrams on manufacturer's standard catalog cuts will not be accepted as meeting this requirement. The drawings shall indicate the connection for fire department notification; and connections to all devices including, but not limited to, trouble bells, audible and visual alarm devices, smoke dampers, automatic detectors and manual stations, and connection for fan shutdown (with fans identified).

3.05. RECORD DOCUMENTS

A. Provide certificate of completion and testing, record drawings indicating the as-built conditions and an owner's manual and installation instructions covering all system components. Comply with all detailed requirements of NFPA-72, Chapter 1, Section 7.

3.06. CLEANING

A. The contractor shall clean all dirt and debris from the inside and the outside of the fire alarm equipment after completion of the installation.

END OF SECTION