TECHNICAL SPECIFICATIONS
BID DOCUMENTS

SPRING PARK ROAD PUMPING STATION REHABILITATION

JEA PROJECT NO. 8002427

JEA
Jacksonville, Florida

March, 2020
(Revised May, 2020)
(Issued for Rebid August, 2020)

J. Collins Engineering Associates, LLC

SPRING PARK ROAD PUMP STATION REHABILITATION

TABLE OF CONTENTS

(Note: Changes from the original bid Table of Contents are shown in *italics*.)

JEA WATER AND WASTEWATER STANDARDS – APPLICABLE SECTIONS TO THIS PROJECT (NOT BOUND IN TECHNICAL SPECIFICATIONS DOCUMENT – GO TO HTTPS://WWW.JEA.COM.)

CHAPTER VI.2. HORIZONTAL DIRECTIONAL DRILLING - SECTION 750 (SMALL DIAMETER PIPE 12 INCHES OR LESS)

SECTION VIII. WATER AND RECLAIMED CONSTRUCTION DETAILS

CHAPTER VIII.1. WATER AND RECLAIMED CONSTRUCTION DETAILS

SECTION IX. WASTEWATER CONSTRUCTION DETAILS

CHAPTER IX.1 WASTEWATER CONSTRUCTION DETAILS

SECTION X. WATER & RECLAIMED APPROVED MATERIALS

CHAPTER X.1 WASTEWATER CONSTRUCTION DETAILS

SECTION XI. WASTEWATER APPROVED MATERIALS

CHAPTER IX.1 WASTEWATER APPROVED MATERIALS

CONTRACTOR shall strictly follow JEA's Water and Wastewater Standards Manual latest edition during the construction of the improvements at the Spring Park Road Pump Station Rehabilitation project as well as these contract documents. CONTRACTOR shall issue a Request for Information in the event of a discrepancy between the contract documents and the JEA's Manual for ENGINEER and OWNER to clarify.

TECHNICAL SPECIFICATIONS

DIVISION 1 - GENERAL REQUIREMENTS

01010	Summary of Work
01012	Project Technical Document Guideline
01014	Construction Sequence
01060	Regulatory Requirements
01300	Submittals
01310	Special Measurement and Payment
01370	Schedule of Values
01400	Quality Control
01500	Construction Facilities
01600	Material and Equipment
01650	Startup
01701	Project Closeout
01730	Operating and Maintenance Data
01740	Warranties and Bonds

DIVISION 2 - SITE WORK

02050	Demolition (Supplement to JEA Specification)
02110	Site Clearing
02140	Dewatering
02222	Building Earthwork
02665	Supports, Anchors And Thrust Control
02831	Fencing & Gates (Supplement to JEA Specification)
02936	Grassing (Supplement to JEA Specification)

DIVISION 3 – CONCRETE WORK

03310	Concrete Work

DIVISION 4 - MASONRY

Not Applicable

DIVISION 5 – METALS

05500	Metal Fabrication
05505	Stair Nosing

DIVISION 6 – WOOD AND PLASTICS

Not Applicable

DIVISION 7 – THERMAL AND MOISTURE PROTECTION

07920	Joint Sealants

DIVISION 8 – DOORS AND WINDOWS

Not Applicable

DIVISION 9 – FINISHES

09900	Painting
09905	Equipment Identification

DIVISION 10 – SPECIALTIES

Not Applicable

DIVISION 11 – EQUIPMENT

11000	Basic Equipment Requirements
11040	Seal Water System
11211	Vertical Dry Pit Solids Handling Pump

DIVISION 12 – FURNISHINGS

Not Applicable

DIVISION 13 – SPECIAL CONSTRUCTION

---	JEA BIOTRICKLING FILTER SYSTEM SPECIFICATION

DIVISION 14 – CONVEYING SYSTEMS

Not Applicable

DIVISION 15 – EQUIPMENT

15010	Mechanical Basic Requirements
15190	Mechanical Identification
15250	Mechanical Insulation
15400	Plumbing
15512	Condensate Drain Piping
15670	Split System Air Conditioning Systems
15865	Fans
15890	Ductwork
15940	Air Inlets and Outlets
15990	Testing, Adjusting and Balancing for HVAC

DIVISION 16 – ELECTRICAL

16000	Electrical Work – General

16150	Electric Motors
16400	Electrical Apparatus
16600	Grounding & Lightning Protection
16900	Instrumentation and Controls

DIVISION 1

GENERAL REQUIREMENTS

SECTION 01010

SUMMARY OF WORK

PART 1 - GENERAL

1.1 - LOCATION OF WORK

A. The project site is the Spring Park Road Pump Station located at 4511 Spring Park Road, Jacksonville, FL 32207.

1.2 - DESCRIPTION OF WORK

A. The work consists of furnishing all labor, materials and equipment necessary to complete the following:

1. Vertical Wastewater Pumps:

a. Replace three (3) existing pumps and all associated components, including but not limited to, pump volute, base, rotating assembly, all bearings and seals, bearing cage, pump inlet elbow, line shafting, intermediate steady bearing(s), and motor.

b. Furnish and install one (1) new pump in the currently vacant position labeled “Pump No. 4”. Provide all associated components including but not limited to, pump volute, base, rotating assembly, all bearings and seals, bearing cage, pump inlet elbow, line shafting, intermediate steady bearing(s), and motor.

2. Replace four (4) flanged plug valves on wastewater pumps suction piping.

3. Replace the discharge flanged plug valves and flanged swing check valves on the three (3) existing wastewater pumps.

4. Furnish and install new flanged discharge plug valve and swing check valve for the new wastewater pump

5. Furnish and install new flanged ductile iron piping and fittings to connect the new wastewater pump to the existing flanged ductile iron discharge header pipe. Remove the existing blind flange on the existing ductile iron discharge header piping.

6. Remove all existing electrical equipment. Furnish and install new electrical equipment as shown and specified.

7. Remove existing Influent Flow Splitter Box top and replace with new cast-in-place concrete top with aluminum hatch cover.

8. Furnish and install new emergency pumpout suction and discharge connections, including all valves, fittings, piping and appurtenances.

9. Remove and dispose of existing Wet Well Aeration piping to the extent shown on the plans.

10. Furnish and install new handrail where indicated.

11. Replace all instrumentation and controls.

12. Furnish and install new clamp-on ultrasonic flow meter with meter vault, valves, fittings and piping.

13. Remove the existing seal water system and replace with new system as shown and specified.

14. Remove the existing flushing water system and replace with new system as shown and specified.

15. Furnish and install all miscellaneous equipment items as shown and described.
16. Remove existing electric unit heaters and all associated existing conduit, cable and controls.
17. Remove the existing Motor Room, Pump Room, Screen Room and Wetwell ventilation system. Furnish and install the new ventilation system as shown and specified.
18. Furnish and install new odor control system, including all instrumentation and controls and duct work.
19. Provide new removable fiberglass covers over the openings at the Wet Well Mezzanine level.
20. Provide new pre-cast JEA-standard electrical building.
21. Replace all interior and exterior lighting fixtures as shown and specified.
22. Interior Painting/Coating:

a. Strip, prime, repair and recoat interior walls, floors, and ceilings.

b. Strip, prime, repair and recoat all non-stainless-steel piping, valves, fittings, equipment, structural supports, equipment guards and other miscellaneous items.

c. Strip, prime, repair and recoat all interior surfaces of Influent Flow Splitter Box, wet well influent channels, and wet well with coating per JEA Standard Section 446 – Specialty Coatings and Linings.

23. Provide bypass pumps, piping, valves, fittings, fencing, controls and connections as required to accomplish bypass of the pumping station for the duration necessary. Provide all labor, equipment and incidental materials which may be required. Fuel for Bypass Pumps will be provided by JEA. Bypassing shall be accomplished in two phases as described on the plans. Bypass Pump enclosures shall be sound attenuating.
24. Remove and dispose of existing Mechanical Bar Screens (2). Install new aluminum handrail around periphery of openings.
25. Remove existing perimeter fence and gates. Furnish and install new security fencing and gates as shown on the plans.
26. Provide renovations to exterior steps and loading docks as shown. Provide new step nosings. Provide new rubber dock bumpers. Recoat steel loading dock edging.
27. Remove exterior graffiti as shown.
28. Provide site improvements including grade adjustments, removal and replacement of existing asphalt paving, addition of new paving, and concrete sidewalk as shown.
29. Remove and dispose of all existing site fencing and gates. Furnish and install new fencing and gates as shown and specified.
30. Regrade and sod all non-paved areas disturbed by contractor operations. Replace all landscaping disturbed by contractor operations with like sizes/species.
31. Repair Influent Junction Manhole ring and cover. Re-point/replace brick adjustment courses as required. Provide new JEA-standard manhole ring and cover.

32. Coordinate with lead abatement program contractor (see paragraph 1.3).

1.3 - LEAD MONITORING/ABATEMENT PROGRAM

A. JEA has initiated a lead monitoring/abatement program at the Spring Park Pump Station. This program began prior to the bidding of this project. The lead monitoring/abatement program is anticipated to be substantially complete by the time the successful bidder mobilizes on this project, however, there are portions of the abatement project that may need to be performed as a parallel activity to the Pumping Station contractor's work.

B. The abatement contractor will require access to the Mezzanine area of the Spring Park Pump Station for one week (5 working days). The successful contractor will NOT HAVE ACCESS TO THE MEZZANINE AREA during this 5-day period.

C. The successful contractor must coordinate his work schedule and effort with that of the lead abatement contractor.

D. The scope of work of the abatement contractor is enclosed as Appendix E – Lead Based Paint Remediation.

1.4 - BASIS OF DESIGN AND SUBSTITUTIONS

A. Drawings indicate the extent and general arrangement of the work. If any departures from the Drawings are deemed necessary by the Contractor to accommodate the such substituted materials and equipment he proposes to furnish, details of such departures and reasons therefore shall be submitted. No such departures shall be made without the prior written approval of the JEA. Approved changes shall be made without additional cost to the JEA for this work or related work under other Contracts of the Project. Refer to Project Solicitation (Substitutions).

B. If the Contractor proposes the use of substitute equipment that requires changes in structures, auxiliary equipment, piping, electrical, mechanical, controls or other work, such substitute equipment and required changes, if approved by JEA, shall be furnished at no additional cost to JEA.

C. In the event that the Engineer is required to provide additional engineering services as a result of substitution of materials or equipment which are not "or equal" by the Contractor, or changes by the Contractor in dimension, weight, power requirements, etc., of the equipment and accessories furnished, or if the Engineer is required to examine and evaluate any changes proposed by the Contractor for the convenience of the Contractor, then the Engineer's charges in connection with such additional services shall be charged to the Contractor by the JEA. Refer to Project Solicitation (Substitutions).

D. Structural design shown on the Contract Drawings is based upon typical weights for major items of equipment as indicated on the Contract Drawings and specified. If the Contractor proposes the use of substitute equipment which differs from that specified in the Contract Documents such that actual weight exceeds the weight of the specified equipment, the Contractor shall assume the responsibility for all costs of redesign and for any construction changes required to accommodate the equipment furnished, including the Engineer's expenses in connection therewith, provided that the original weight assumptions were correct.

1.5 - CONTRACTOR'S DUTIES

A. Except as specifically noted, the Contractor shall provide and pay for the following:

1. All labor, materials and equipment.

2. Tools, construction equipment and machinery.

3. Utilities required for construction.

4. Other services and facilities necessary for the proper execution of work completion including incidental items not detailed or called for, but which are required for the proper completion of the project.
5. All legally required sales, consumer and use taxes.
6. All applicable permits, government fees and licenses.
7. Survey services for construction layout and asbuilt drawings.
8. All required testing and clearances for placing in service.

B. Comply with all codes, ordinances, rules, regulations, orders and other legal requirements of public authorities which bear on the performance of work. Contractor to perform all work in accordance with Water & Wastewater Standards Manual as referenced within these technical specifications and on the drawings. JEA SPECIFICATIONS GOVERN OVER ALL TECHNICAL SPECIFICATIONS.

C. Promptly submit written notice to JEA and the Engineer of observed variances of Contract Documents from legal requirements; it is not the Contractors responsibility to make certain drawings and specifications comply with codes and regulations.

D. Enforce strict discipline and good order among employees. Do not employ unfit persons or those not skilled in assigned tasks.

1.6 - WORK SEQUENCE

A. Conform to requirements of Section 02050 Demolition and Bypassing

B. Coordinate with JEA Staff associated with the Construction Administration of this project

C. Notify JEA seven (7) days in advance of removing any facility from service, permanently or temporarily. Removal from service of any facility shall be preapproved by JEA.

1.7 - CONTRACTORS USE OF PREMISES

A. Do not unreasonably encumber sites with materials or equipment.

B. Assume full responsibility for protection and safekeeping of products stored on premises.

C. Move any stored products interfering with operation of Owner.

PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION (NOT APPLICABLE)

END OF SECTION

SECTION 01012

PROJECT TECHNICAL DOCUMENT GUIDELINE

PART 1 – GENERAL

1.01 PROJECT DOCUMENTS.

A. This section is an overview of Technical Project Documents to be used by the Contractor to furnish/install equipment, provide labor and construct the scope of work. Technical Project Documents include: Drawings which are composed of the following specialties:

1. General
2. Civil
3. Stormwater pollution prevention
4. Civil standard details
5. Painting, coating, demolition, and repairs
6. Mechanical
7. Mechanical standard details
8. Odor control system
9. Odor control system details
10. HVAC
11. Plumbing
12. Structural
13. Electrical
14. JEA Standard Reference Drawings
15. Technical Specifications (these documents)
16. JEA Water & Wastewater Standards Manual (available on JEA.COM).

1.02 GUIDELINE

A. Construction Sequence – Contractors schedule and startup/execution of the work shall comply with Construction Sequence detailed within these specifications.

B. Civil Construction -This work includes limited clearing, excavation, erosion control and final grading/restoration/paving, sidewalks, bollards and associated work. Applicable specifications are included in Division 2 of the Technical Specifications as well as JEA Standards. Drawings are the “C”, “CP and “CD” sheets, applicable JEA Standard Details, and applicable JEA Water and Wastewater Standards.

C. Painting, Coating, Demolition and Repairs – This work includes the surface preparation and painting, specialty coatings, and demolition/removal, and repair of various components of the pump station. Applicable specifications are included in Divisions 2 through 16 of the Technical Specifications. Drawings are the “PD”, “PR” and “PS” sheets, applicable JEA Standard Details, and applicable JEA Water and Wastewater Standards.

D. Mechanical - This work includes the mechanical portion of the project which includes the new pumps, seal water pump system, water booster system, HVAC equipment, and associated piping, fittings and valves. Drawings are the “M” and “MD” sheets and applicable JEA Standard Details. Specifications for installation of new pipe is included in

JEA Standards (Potable Water Piping - Section 350 and Wastewater Force Mains – Section 429). Details for installation of new piping including separation requirements for water/wastewater piping; pipe restraint; utility field adjustments over or under existing WRF yard piping/electrical ducts; and locate wire for piping is detailed in JEA Standard Details included in Section VIII and IX of the JEA Water and Wastewater Standards.

E. Odor Control Equipment – This work includes the odor control equipment. Drawings are the "O" and "OD" sheets, and applicable JEA Standard Details. Applicable specification sections are Division 2 through 16 as well as the JEA Water and Wastewater Standards.

F. HVAC Equipment – This work includes the heating, ventilation and air conditioning equipment for the project, including ductwork for the HVAC and Odor Control Equipment. Drawings are the "H" sheets and applicable JEA Standard Details. Applicable specification sections are Division 2 through 16 as well as the JEA Water and Wastewater Standards.

G. Plumbing – This work includes the plumbing fixtures, equipment and piping. Drawings are the "PL" sheets and applicable JEA Standard Details. Applicable specification sections are Division 2 through 16 as well as the JEA Water and Wastewater Standards.

H. Structural – This work includes concrete equipment pads for equipment, foundation plan for electrical building, support of HVAC equipment located on the roof and new concrete top for influent splitter box. Drawings are the "S" sheets and applicable JEA Standard Details. Applicable specifications are included in Division 3 of the Technical Specifications as well as the JEA Water and Wastewater Standards..

I. Electrical – This work includes the electrical conduit/conductors, control panels, MCC, VFDs, precast concrete electrical building, instrumentation, controls, and other electrical equipment associated with the equipment associated with the pumping station. Drawings are the "E" sheets and applicable JEA Standard Details. Applicable specifications are included in Division 16 of the Technical Specifications as well as the JEA Water and Wastewater Standards.

PART 2 – PRODUCTS (NOT APPLICABLE)

PART 3 – EXECUTION (NOT APPLICABLE)

END OF SECTION

SECTION 01014

CONSTRUCTION SEQUENCE

PART 1 GENERAL

1.01 GENERAL REQUIREMENTS

A. This project consists of work on property owned by JEA. The Spring Park Road Pump Station must remain in continuous operation during construction of this project. Coordination by the CONTRACTOR with the OWNER will be necessary. All coordination shall be in the presence of the OWNER and ENGINEER and shall be confirmed in writing by the OWNER in order to be valid.

B. The OWNER reserves the right to postpone shutdowns due to operational and/or weather related concerns.

1.02 DEFINITIONS AND TERMS

A. Construction Scheduling Constraints: Constraints for performance of the Work, required because of special sequencing with other parts of the Work, calendar time constraints and special testing, commissioning and procedures are identified in this Section. These constraints are in addition to the standard procedural constraints such as shop and working drawings, testing, commissioning, training, etc. These constraints shall be included in the CONTRACTOR's progress schedule.

B. Special Conditions: Certain special conditions related to performance of the Work are identified in this Section and shall be included in the CONTRACTOR's progress schedule.

1.03 NOTIFICATION REQUIREMENTS

A. The CONTRACTOR shall give a minimum of 30 days advance written notice to the ENGINEER of each component proposed for shutdown, tie-in, or disruption, all of which shall be subject to OWNER'S approval and limitations.

1.04 SUBMITTAL REQUIREMENTS

A. CONTRACTOR shall submit shop drawings and working drawings to show details of all temporary services, bypasses, shutdowns, tie-ins, and connections to existing systems.

1.05 SITE CONDITIONS

A. Several areas of construction under this contract must be coordinated with the JEA Operating Personnel and accomplished in a logical order to maintain the operation of the Pump Station and to allow construction to be completed within the time allowed by the Contract Documents. Coordinate construction activities with the OWNER and the ENGINEER to allow orderly and timely completion of all the work.

B. When access through construction areas must be disrupted, provide alternate acceptable access for the plant operators or other contractors.

C. Coordinate construction activities in the construction areas with the OWNER. Submit to the OWNER and the ENGINEER a description and schedule as to how the common areas will be utilized, recognizing the required coordination with the operations staff. Access to existing process equipment must be provided to the Operating Personnel unless identified following the procedures noted in this specification section.

D. Various interconnections within the plant may require temporary partial power shutdown. Make every effort necessary to minimize the shutdown time and coordinate with the OWNER's Representative and the Plant Operating Personnel and/or utility authorities prior to attempting any such power shutdown. Furthermore, provide any corrective measure or temporary facilities necessary to perform the work at no additional cost to the OWNER and without interrupting the plant operation.

E. When the work requires an existing facility to be taken out of operation, temporarily or permanently, notify the ENGINEER and OWNER in writing 30 days in advance. In addition, the shut-down plan shall be submitted and approved prior to work being completed.

F. Where reuse water or potable water is required in large quantities for testing or other use, CONTRACTOR shall provide all necessary facilities for transferring the water from the nearest OWNER approved source. CONTRACTOR shall pay all costs associated with obtaining the water from the point of supply, delivering it to the point of use, and returning the water to the head of the treatment process at a flow rate acceptable to the OWNER. The OWNER will provide the reuse water and potable water free of charge, and potable water use will only be allowed for typical potable water use.

G. During all Start-Up and Performance Testing activities, make available the manpower, equipment and manufacturer's representatives required to make any necessary adjustments and training.

H. The existing plant will be in operation during the entire construction period and the CONTRACTOR shall conduct their operations so as to cause the lease possible interference and/or inconvenience with the normal operations of the facility. Dust-tight partitions or other methods approved by the ENGINEER to contain dust, debris, rain, etc., from construction areas shall be provided. Protective covers for equipment, furnishings, and water filled basins shall be provided by the CONTRACTOR in areas of work within existing buildings and structures.

1.06 CONSTRUCTION CONSTRAINTS

A. The Contractor shall meet the constraints below, and shall consider these constraints when developing the overall plan of construction. These constraints are not intended to release the CONTRACTOR from the responsibility to coordinate the work in any manner which will ensure project completion within the time allowed. The areas are not necessarily listed in their required sequence of construction. A suggested sequence within each area, where necessary, is included.

B. Sitework

1. Erosion control and temporary fencing of all construction areas shall be performed within 30 days after the Notice to Proceed. All erosion control devices and storm drainage piping and inlets shall be installed prior to any clearing and grubbing in this area. Clearing and grubbing shall be completed within 30 days after the demolition. The two time frames can overlap, but all activities must be completed within 60 days from notice to proceed.

2. All underground pipes, conduits, cables, duct banks, and structures shall be located by electronic locator equipment and test pits in each area of excavation and flagged and mapped before any excavation is performed for structures, pipes, cables, conduits, duct banks, or removals. Working drawings of existing and proposed new work shall be prepared to scale and submitted to the ENGINEER in advance of excavation. The CONTRACTOR shall be fully responsible for any process outages caused by disruption of underground facilities including responsibility for regulatory fines and the OWNER's costs of dealing with regulatory agencies.

3. All underground pipes, conduits, cables, duct banks, and structures installation work shall be organized and scheduled to accomplish the following:
   a. The OWNER access to operating facilities shall be maintained at all times.
   b. All underground work in each area shall be performed concurrently to avoid subsequent trenching through the same areas.
   c. Yard electrical work and piping work shall be shown on the same working drawings and fully coordinated horizontally and vertically.
   d. Existing systems shall remain fully operational except for pre-planned, scheduled, and organized temporary outages.

4. Locations and numbers of sedimentation control facilities shall be adjusted as the work progresses so that all site runoff flows through sedimentation control facilities at all times. At no time shall water that has not been through silt barriers and is not clear be allowed to leave the site. Maintenance and upgrading of facilities shall be scheduled weekly and after all rain events.

5. The CONTRACTOR shall submit a Notice of Intent to Use Noticed General Permit for Short Term Construction Dewatering to the St. Johns River Water Management District prior to starting any dewatering activity at the project site.

6. All connections to existing facilities shall be scheduled through the ENGINEER and the OWNER to minimize the impact on operations and construction progress.

C. Bypass of Pump Station
   1. Construction Sequence
      a. Bypassing must be accomplished in general accordance with the plan shown on the project drawings. Bypassing Plan to be submitted to JEA and Engineer prior to start of demolition work. Bypassing to be in place while pumping station rehabilitation is performed. Prior to start of bypassing operation Contractor shall coordinate and verify with OWNER that the facility is properly prepared for bypassing.

D. Electrical

1. There shall be no demolition work or shutdowns of existing electrical systems unless/until approved by the ENGINEER and the OWNER. Direct conflicts may exist with the new work. The CONTRACTOR shall plan in advance for work in each area and each facility and shall determine where conflicts exist by electronic locating and exploratory excavation. All conflicts shall be brought to ENGINEER's attention and shall be remedied by the CONTRACTOR at no change in Contract Amount or Time. Existing yard lights and miscellaneous electrical facilities shall be similarly temporarily or permanently relocated as appropriate. All relocations and other remedies shall be planned in advance and submitted to the ENGINEER for approval.

E. Testing

1. All facilities and systems shall be tested as a condition precedent to substantial completion. See equipment specifications for additional requirements. Start-up plans for each facility and equipment shall be submitted, reviewed and approved by the ENGINEER.

2. All equipment and facilities shall be tested according to:

   Stage 1 - Pre-startup Testing: All components, subsystems, and systems in each process component and associated process component shall be checked before electrical and process fluids are applied, and these checks shall verify completeness, leakage, electrical and instrumentation connections and circuit correctness, and correct installation. Equipment suppliers and all trades must certify that the respective systems are ready for operation. The ENGINEER shall inspect and must agree that each system is ready for energizing and process fluids. The ENGINEER and OWNER's Representative shall be present for verification of prestart up testing.

   Stage 2 - Operational Testing: All systems shall be operated with staff to verify that all components, sub-systems, and systems operate correctly and meet individual performance requirements and that electrical, control, and instrumentation systems function satisfactorily. Corrections, adjustments, replacements, calibrations and training shall take place during this stage. All systems must be functionally complete and 100 percent satisfactory and ready for process start-up and continuous operation at the conclusion of this stage. Details on operational testing requirements are specified in the respective process component specifications. The ENGINEER and OWNER's Representative shall be present for verification of operational testing. Final training shall take place during operational testing.

   Stage 3 Performance Testing: Performance testing shall be conducted after the respective systems and all associated process systems have been started and are operating continuously and satisfactorily. Demonstration of successful performance testing shall be a condition precedent to final completion. Details on performance testing shall be provided by manufacturer. The ENGINEER and OWNER's Representative shall be present for verification of performance testing.

1.07 PERMITS

A. The CONTRACTOR shall arrange for all required inspections and shall close out the permits at the end of the Contract.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01060

REGULATORY REQUIREMENTS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

A. The general provisions of the Contract, including all applicable JEA General or Supplementary Conditions apply to the work specified in this section.

1.02 SPECIFIED CODES:

A. The design of the work is based on the requirements of the latest edition of the Southern Standard Building Code, National Electric Code and National Fire Protection Association Requirements, whichever is most stringent.

B. The Contractor shall ensure the work complies to the aforementioned codes and regulations as they apply to the project whether or not specifically referenced elsewhere.

1.03 PERMITS:

A. Determination of necessity and/or application for and receipt of the following permits will be required of the Contractor, unless otherwise noted. The Contractor shall comply with all provisions of these permits. No work shall commence until all required permits are in hand or conditions of any attached permits are met:

1. No FDEP construction permit is associated with this project.
2. NPDES – Generic Permit for the Discharge of Produced Groundwater from any Non-Contaminated Site Activity. Contact Florida Department of Environmental Protection (FDEP), Northeast District. Permit is included in the Appendix of these specifications.

PART 2 – PRODUCTS (NOT APPLICABLE)

PART 3 – EXECUTION (NOT APPLICABLE)

END OF SECTION

SECTION 01300

SUBMITTALS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Administrative and procedural requirements for submittals required for performance of the Work, including the following:

1. Contractor's construction schedule.

2. Shop Drawings.

3. Product Data.

4. Quality assurance submittals.

5. Contractor Completed Asset Worksheet

1.02 DEFINITIONS

A. Coordination Drawings show the relationship and integration of different construction elements that require careful coordination during fabrication or installation to fit in the space provided or to function as intended.

B. Field samples are full-size physical examples erected on-site to illustrate finishes, coatings, or finish materials. Field samples are used to establish the standard by which the Work will be judged.

1.03 SUBMITTAL PROCEDURES

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

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

2. Coordinate transmittal of different types of submittals for related elements of the Work so processing will not be delayed by the need to review submittals concurrently for coordination. The Engineer reserves the right to withhold action on a submittal requiring coordination with other submittals until all related submittals are received.

3. Processing: To avoid the need to delay installation as a result of the time required to process submittals, allow sufficient time for submittal review, including time for resubmittals.

a. Allow 15 working days for initial review. Allow additional time if the Engineer must delay processing to permit coordination with subsequent submittals.

b. If an intermediate submittal is necessary, process the same as the initial submittal.

c. Allow 15 working days for reprocessing each submittal.

d. No extension of Contract Time will be authorized because of failure to transmit submittals to the Engineer sufficiently in advance of the Work to permit processing.

B. Submittal Preparation: Place a permanent label or title block on each submittal for identification. Indicate the name of the entity that prepared each submittal on the label or title block.

1. Provide a space approximately 4 by 5 inches (100 by 125 mm) on the label or beside the title block on Shop Drawings to record the Contractor's review and approval markings and the action taken.

2. Include the following information on the label for processing and recording action taken.

a. Project name.

b. Date.

c. Name and address of the Engineer.

d. Name and address of the Contractor.

e. Name and address of the subcontractor.

f. Name and address of the supplier.

g. Name of the manufacturer.

h. Number and title of appropriate Specification Section.

i. Drawing number and detail references, as appropriate.

C. Submittal Transmittal: Package each submittal appropriately for transmittal and handling. Transmit each submittal from the Contractor to the Engineer using a transmittal form. The Engineer will not accept submittals received from sources other than the Contractor and without Contractor’s review and approval markings and the action taken.

D. Provide required Product Code Certification with Shop Drawings. Submittals that do not have Product Code Certification included will be returned for resubmission.

1.04 CONTRACTOR'S CONSTRUCTION SCHEDULE

A. JEA Project Manager will detail the specific type required for this project. As a minimum the schedule shall be as listed in paragraph 2.13.2 of the JEA project solicitation.

B. Schedule Updating: Revise the schedule after each meeting, event, or activity where revisions have been recognized or made. Issue the updated schedule concurrently with the report of each meeting.

1.05 SHOP DRAWINGS

A. Submit newly prepared information drawn accurately to scale. Highlight, encircle, or otherwise indicate deviations from the Contract Documents.

1. Do not reproduce Contract Documents or copy standard information as the basis of Shop Drawings.

2. Standard information prepared without specific reference to the Project is not a Shop Drawing.

B. Shop Drawings include fabrication and installation Drawings, setting diagrams, schedules, patterns, templates and similar Drawings. Include the following information:

1. Dimensions.

2. Identification of products and materials included by sheet and detail number.

3. Compliance with specified standards.

4. Notation of coordination requirements.

5. Notation of dimensions established by field measurement.

6. Do not use Shop Drawings without an appropriate final stamp indicating action taken.

C. Submittals: Submit four (4) copies plus however many additional copies the Contractor would like returned. The number of copies may be changed by the Owner or Engineer.

1.06 PRODUCT DATA

A. Collect Product Data into a single submittal for each element of construction or system. Product Data includes printed information, such as manufacturer's installation instructions, catalog cuts, standard color charts, roughing-in diagrams and templates, standard wiring diagrams, and performance curves.

1. Mark each copy to show applicable choices and options. Where printed Product Data includes information on several products that are not required, mark copies to indicate the applicable information. Product Data not so marked will be returned without review. Include the following information:

a. Manufacturer's printed recommendations.

b. Compliance with trade association standards.

c. Compliance with recognized testing agency standards.

d. Application of testing agency labels and seals.

e. Notation of dimensions verified by field measurement.

f. Notation of coordination requirements.

2. Do not submit Product Data until compliance with requirements of the Contract Documents has been confirmed.

C. Submittals: Submit 2 copies of each required submittal; submit 4 copies where required for maintenance manuals. Submit additional copies as required by the Contractor for distribution. The Engineer will retain one and will return the others marked with action taken and corrections or modifications required.

D. Repetitive Reviews: Shop drawings, O&M manuals and other submittals will be reviewed no more than twice at the Owner's expense. All subsequent reviews will be performed at the Contractor's expense. Reimburse the Owner for all costs invoiced by Engineer for the third and subsequent reviews.

E. Distribution: Furnish copies of final submittal to installers, subcontractors, suppliers, manufacturers, fabricators, and others required for performance of construction activities.

1.07 QUALITY ASSURANCE SUBMITTALS

A. Submit quality-control submittals, including design data, certifications, manufacturer's instructions, manufacturer's field reports, and other quality-control submittals as required under other Sections of the Specifications.

B. Certifications: Where other Sections of the Specifications require certification that a product, material, or installation complies with specified requirements, submit a notarized certification from the manufacturer certifying compliance with specified requirements. Signature: Certification shall be signed by an officer of the manufacturer or other individual authorized to sign documents on behalf of the company.

C. Inspection and Test Reports: Requirements for submittal of inspection and test reports from independent testing agencies are specified in Division 1 Section "Quality Control."

1.08 ENGINEER'S ACTION

A. Except for submittals for the record or information, where action and return is required, the Engineer will review each submittal, mark to indicate action taken, and return promptly. Compliance with specified characteristics is the Contractor's responsibility regardless of action indicated.

B. Action Stamp: The Engineer will stamp each submittal with a uniform, action stamp. The Engineer will mark the stamp appropriately to indicate the action taken. Do not use, or allow others to use, submittals marked "Not Approved, Revise and Resubmit" at the Project Site or elsewhere where Work is in progress.

C. Other Action: Where a submittal is for information or record purposes or special processing or other activity, the Engineer will return the submittal marked "Action Not Required."

D. Unsolicited Submittals: The Engineer will return unsolicited submittals to the sender without action.

1.09 CONTRACTORS REQUIREMENTS ON JEA ASSET MANAGEMENT DOCUMENTATION

A. Asset information is to be provided by the Contractor for all equipment on the project. Appendix contains JEA Asset Worksheet for Contractor to complete. Comply with Asset Management specifications as detailed in Operation and Maintenance Data – Section 445.

PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION (NOT APPLICABLE)

END OF SECTION

SECTION 01310
SPECIAL MEASUREMENT AND PAYMENT

1.01 General

A. The requirements of this section apply to the following:

1. The existing concrete preparation and repair as described in JEA Water & Wastewater Standards Manual (latest), section 448 “Existing Concrete Preparation & Repair”, and,

2. Provision and placement of granular #57 stone material.

B. Measurement and payment will be based upon work completed and accepted in accordance with the Contract Documents. No separate payment will be made for excavation, trenching, dewatering, backfilling, leakage testing, surveying, concrete or soil testing, bypass pumping, mobilization, overhead costs, paving, grading, bacteriological testing or other incidental items of work not shown in the Agreement. The described items apply for all applicable parts in the Bid Form.

C. No payment will be made for any work or item of work that is deemed unacceptable by the Owner or Engineer.

D. Measurement and payment for unit price items will be based on the actual quantities installed or work performed.

1.02 Measurement and Payment

A. TYPE A REPAIR: PARTIAL DEPTH REPAIR – UP TO 0.5"

1. Measurement: Measurement will be the actual square feet of horizontal, overhead and/or vertical repair(s) (up to 0.5” depth) performed.

2. Payment: Payment will be made at the contract unit price per square foot and shall be full compensation for all labor, materials and equipment required to complete the cleaning, water blasting, debris removal and crack repair.

3. The final coating/lining system is NOT included in this item. This is paid for separately and is included in the Part A – Base Bid lump sum pricing.

B. TYPE B REPAIR: PARTIAL DEPTH REPAIR – 0.5” TO 3.0"

1. Measurement: Measurement will be the actual square feet of horizontal, overhead and/or vertical repair(s) (0.5” to 3.0” depth) performed.

2. Payment: Payment will be made at the contract unit price per square foot and shall be full compensation for all labor, materials and equipment required to complete the crack repair including cleaning, water blasting, surface preparation, reinforcing bar removal and placement of new reinforcing bar, placement of new welded wire mesh, debris removal.

3. The final coating/lining system is NOT included in this item. This is paid for separately and is included in the Part A – Base Bid lump sum pricing.

C. TYPE C REPAIR: FULL DEPTH REPAIR (without reinforcement rehabilitation)

1. Measurement: Measurement will be the actual square feet of horizontal, overhead and/or vertical repair(s) performed.

2. Payment: Payment will be made at the contract unit price per square foot and shall be full compensation for all labor, materials and equipment required to complete the crack repair including cleaning, water blasting, surface preparation, and debris removal.

3. The final coating/lining system is NOT included in this item. This is paid for separately and is included in the Part A – Base Bid lump sum pricing.

D. TYPE D REPAIR: FULL DEPTH REPAIR (with reinforcement rehabilitation)

1. Measurement: Measurement will be the actual square feet of horizontal, overhead and/or vertical repair(s) performed.

2. Payment: Payment will be made at the contract unit price per square foot and shall be full compensation for all labor, materials and equipment required to complete the crack repair including cleaning, water blasting, surface preparation, and debris removal.

3. The final coating/lining system is NOT included in this item. This is paid for separately and is included in the Part A – Base Bid lump sum pricing.

E. TYPE E REPAIR: FULL DEPTH REPAIR (with reinforcement rehabilitation)

1. Measurement: Measurement will be the actual linear feet of horizontal, overhead and/or vertical repair(s) performed.

2. Payment: Payment will be made at the contract unit price per linear foot and shall be full compensation for all labor, materials and equipment required to complete the crack repair including cleaning, water blasting, surface preparation, and debris removal.

3. The final coating/lining system is NOT included in this item. This is paid for separately and is included in the Part A – Base Bid lump sum pricing.

F. GRANULAR MATERIAL (#57 STONE)

1. This material shall be measured and paid for as described in JEA Water & Wastewater Standards Manual (latest), Section 801 – “Measurement and Payment”, paragraph IV – “Excavation and Earthwork”.

END OF SECTION

SECTION 01370

SCHEDULE OF VALUES

PART 1 - GENERAL

1.01 DESCRIPTION:

A. Work Included: Provide a detailed breakdown of the agreed Contract Sum showing values allocated to each of the various parts of the work, as specifies herein, and in other provisions of the Contract Documents.

B. Related Work: Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of these Specifications.

1.02 QUALITY ASSURANCE:

A. Use required means to assure arithmetical accuracy of the sum described.

B. When so required by the Engineer, provide copies of the subcontracts or other data acceptable to the Engineer substantiating the sums described

C. Unbalanced or front-end loaded schedule will not be accepted.

D. Lump Sum:
   1. Show specified allowances/alternatives if applicable
   2. Provide complete breakdown of all work including a breakdown of components of the project. Also provide costs of bonds/insurance premiums, mobilization, demobilization, preliminary and detailed progress schedule, equipment testing, startup and closeout.

1.03 SUBMITTALS

A. Prior to commencement, submit a proposed schedule of values to the Engineer.

1. Meet with the Engineer and determine data, if any, required to be submitted.

2. Secure the Engineer's approval of the values prior to commencement.

PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION (NOT APPLICABLE)

END OF SECTION

SECTION 01400

QUALITY CONTROL

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Administrative and procedural requirements for quality control services and testing and inspection laboratory services.

1.02 GENERAL

A. Specific quality control requirements for individual construction activities are specified in the Sections that specify those activities. Those requirements, including inspections and tests, cover production of standard products as well as customized fabrication and installation procedures.

B. Inspections, test and related actions specified are not intended to limit the Contractor's quality control procedures that facilitate compliance with Contract Document requirements.

C. Requirements for the Contractor to provide quality control services required by the Engineer, Owner, or authorities having jurisdiction are not limited by provisions of this Section.

1.03 CONTRACTOR RESPONSIBILITIES

A. Provide inspections, tests and similar quality control services specified in individual Specification Sections as the Contractor's responsibility and as required by governing authorities; these services include those specified to be performed by an independent agency and not by the Contractor. Include costs for these services in the Contract Sum.

B. Provide and pay for costs of retesting and other related costs when:

1. Results of required inspections, tests or similar services prove unsatisfactory and do not indicate compliance with Contract Document requirements, regardless of whether the original test was the Contractor's responsibility.

2. Construction is revised or replaced by the Contractor, where tests were required on original construction.

3. Additional testing is needed or required by the Contractor.

4. Additional trips to the project are necessary by an agency when scheduled times for tests and inspections are cancelled and the agency is not notified sufficiently in advance of cancellation to avoid the trip.

C. Cooperate with agencies performing required inspections, tests and similar services and provide reasonable auxiliary services as requested.

1. Notify the agency sufficiently in advance of operations to permit assignment of personnel.

2. Provide access to the Work and furnish incidental labor and facilities necessary to facilitate inspections and tests.

3. Take adequate quantities of representative samples of materials that require testing and assist the agency in taking samples.

4. Provide facilities for storage and curing of test samples.

5. Provide the agency with a preliminary design mix proposed for use for materials mixes that require control by the testing agency.

6. Secure and protect samples and test equipment at the Project site.

D. Coordinate the sequence of activities to accommodate required services with a minimum of delay and coordinate activities to avoid the necessity of removing and replacing construction to accommodate inspections and tests.

E. Schedule times for inspections, tests, taking samples and similar activities.

1.04 OWNER RESPONSIBILITIES

A. Provide inspections, tests and similar quality control services specified, except where they are specifically indicated as the Contractor's responsibility or are provided by another identified entity.

1. Costs for these services are not included in the Contract Sum.

2. The Owner will employ and pay for the services of an independent agency, testing laboratory or other qualified firm to perform the services required.

1.05 TESTING AGENCIES RESPONSIBILITIES

A. Cooperate with the Engineer and Contractor in performance of their duties; provide qualified personnel to perform required inspections and tests.

B. Notify the Engineer and Contractor promptly of irregularities or deficiencies observed in the Work during performance of their services.

C. Agencies are not authorized to release, revoke, alter or enlarge requirements of the Contract Documents, or approve or accept any portion of the Work.

D. Agencies shall not perform any duties of the Contractor.

1.06 SUBMITTALS

A. Independent testing agencies shall submit 2 copies of certified written reports of each inspection, test or similar service to the Engineer and to the Contractor.

B. Report Data: Written reports of each inspection, test or similar service shall include:

1. Date of issue.

2. Project title and number.

3. Name, address and telephone number of testing agency.

4. Dates and locations of samples and tests or inspections.

5. Names of individuals making the inspection or test.

6. Designation of the Work and test method.

7. Identification of product and Specification Section.

8. Complete inspection or test data.

9. Test results and an interpretations of test results.

10. Ambient conditions at the time of sample-taking and testing.

11. Comments or professional opinion as to whether inspected or tested Work complies with Contract Document requirements.

12. Name and signature of laboratory inspector.

13. Recommendations on retesting.

1.07 QUALIFICATION OF SERVICE AGENCIES

A. Engage inspection and testing service agencies, including independent testing laboratories, which are prequalified as complying with "Recommended Requirements for Independent Laboratory Qualification" by the American Council of Independent Laboratories, and which specialize in the types of inspections and tests to be performed.

B. Each independent inspection and testing agency engaged on the Project shall be authorized by authorities having jurisdiction to operate in the State in which the Project is located.

C. Inspection and testing agencies engaged by the Contractor shall be acceptable to Engineer and Owner.

PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION

3.01 REPAIR AND PROTECTION

A. Upon completion of inspection, testing, sample-taking and similar services, repair damaged construction and restore substrates and finishes to eliminate deficiencies, including deficiencies in visual qualities of exposed finishes.

B. Protect construction exposed by or for quality control service activities, and protect repaired construction.

C. Repair and protection is the Contractor's responsibility, regardless of the assignment of responsibility for inspection, testing or similar services.

END OF SECTION

SECTION 01500

CONSTRUCTION FACILITIES

PART 1 – GENERAL

1.01 DESCRIPTION

A. The following criteria shall govern the furnishing of and paying for temporary construction and service items. Such items shall be instituted at the beginning and maintained for the life of the work or until removal or termination is approved by the Engineer.

1.02 TEMPORARY FACILITIES:

A. Drinking Water: The Contractor shall provide cool, potable water with dispensing utilities.

B. The Contractor shall provide proper back flow devices in order to comply with regulations concerning back flow & cross connection.

C. It shall be the Contractor's responsibility to provide temporary electrical power for construction purposes.

D. Toilet Facilities: The Contractor shall furnish a portable, job-site toilet enclosure facility through a local company specializing and licensed in this business. The toilet enclosure shall be located on the project site at a point approved by the Owner. It shall be maintained daily by the supplying company and removed from the project site upon completion of the project.

1.03 SECURITY

A. General: The Contractor shall provide security, as necessary or required, to protect work and property at all times.

B. Rodents and Other Pests: The Contractor, through debris removal, etc., shall control the creation of rodent or pest problems. Should such develop, the Contractor shall secure services of exterminator to control.

C. Debris Control: Keep premises clean and free from accumulation of debris and rubbish. Provide trash and debris receptacles and require use. Remove from site at least weekly.

D. Cleaning: As work is completed by trades, areas of work shall be cleaned in preparation for next trade, inspections or general safety of property and person.

E. Project Safety: The Contractor shall comply with all applicable governmental and insuring company requirements relative to construction and project safety. Either the superintendent or another company representative on the site during all working hours, shall be trained in project safety and designated as Contractor's Safety Director.

1.04 QUALITY ASSURANCE:

A. Comply with industry standards and applicable laws and regulations of authorities having jurisdiction, including but not limited to:

1. Building Code Requirements
2. Health and Safety Regulations
3. Utility Company Regulations
4. Police, Fire Department and Rescue Squad Rules
5. Environmental Protection Regulations

PART 2 – PRODUCTS (NOT APPLICABLE)

PART 3 – EXECUTION (NOT APPLICABLE)

END OF SECTION

SECTION 01600

MATERIAL AND EQUIPMENT

PART 1 - GENERAL

1.01 DESCRIPTION

A. Scope of Work: Material and equipment incorporated into the Work:

1. Manufactured and fabricated products:

a. Design, fabricate and assemble in accord with the best engineering and shop practices.

b. Manufacture like parts of duplicate units to standard sizes and gauges, to be interchangeable.

c. Two (2) or more items of the same kind shall be identical, by the same manufacturer.

d. Products shall be suitable for service conditions.

e. Equipment capacities, sizes and dimensions shown or specified shall be adhered to unless variations are specifically approved in writing.

2. Do not use material or equipment for any purpose other than that for which it is designed or specified.

1.02 MANUFACTURER'S INSTRUCTIONS FOR INSTALLATION

A. When Contract Documents require that installation of work shall comply with manufacturer's printed instructions, obtain and distribute copies of such instructions to parties involved in the installation, including five copies of the Engineer.

1. Maintain one (1) set of complete instructions at the job site during installation and until completion.

B. Handle, install, connect, clean, condition and adjust products in strict accord with such instructions and in conformity with specified requirements.

1. Should job conditions or specified requirements conflict with manufacturer's instructions, consult with Engineer for further instructions.

2. Do not proceed with work without clear instructions.

C. Perform work in accordance with manufacturer's instructions. Do not omit any preparatory step or installation procedure unless specifically modified or exempted by Contract Documents.

1.03 TRANSPORTATION AND HANDLING

A. Arrange deliveries of products in accordance with progress schedules, coordinate to avoid conflict with work and conditions at the site.

1. Deliver products in undamaged condition, in manufacturer's original containers or packaging, with identifying labels intact and legible.

2. Immediately on delivery, inspect shipments to assure compliance with requirements of Contract Documents and approved submittals, and that products are properly protected and undamaged.

B. Provide equipment and personnel to handle products by methods to prevent soiling or damage to products or packaging.

1.04 STORAGE AND PROTECTION

A. The Contractor shall furnish a covered, weather-protected storage structure providing a clean, dry, noncorrosive environment for a" mechanical equipment, valves, architectural items, electrical and instrumentation equipment, and special equipment to be incorporated into this Project. Storage of equipment shall be in strict accordance with the "instructions for storage" of each equipment supplier and manufacturer including connection of heaters, placing of storage lubricants in equipment, etc. Corroded, damaged or deteriorated equipment and parts shall be replaced before acceptance of the project. Equipment and materials not properly stored will not be included in a payment estimate.

B. Store products in accord with manufacturer's instructions, with seals and labels intact and legible.

1. Store products subject to damage by the elements in weather-tight enclosures.

2. Maintain temperature and humidity within the ranges required by manufacturer's instructions.

3. Store fabricated products above the ground, on blocking or skids, prevent soiling or staining. Cover products which are subject to deterioration with impervious sheet coverings, provide adequate ventilation to avoid condensation.

4. Store loose granular materials in a well-drained area on solid surfaces to prevent mixing with foreign matter.

C. All materials and equipment to be incorporated in the work shall be handled and stored by the Contractor before, during and after shipment in a manner to prevent warping, twisting, bending, breaking, chipping, rusting, and any injury, theft or damage of any kind whatsoever to the material or equipment.

D. Cement, sand and lime shall be stored under a roof and off the ground and shall be kept completely dry at all times. All structural and miscellaneous steel, and reinforcing steel shall be stored off the ground or otherwise to prevent accumulations of dirt or grease, and in a position to prevent accumulations of standing water and to minimize rusting. Beams shall be stored with the webs vertical. Precast concrete beams shall be handled and stored in a manner to prevent accumulations of dirt, standing water, staining, chipping or

cracking. Brick, block and similar masonry products shall be handled and stored in a manner to reduce breakage, chipping, cracking and spalling to a minimum.

E. All materials which, in the opinion of the Engineer, have become so damaged as to be unfit for the use intended or specified shall be promptly removed from the site of the work and the Contractor shall receive no compensation for the damaged material or its

F. Arrange storage in a manner to provide easy access for inspection. Make periodic inspections of stored products to assure that products are maintained under specified conditions, and free from damage or deterioration.

G. Protection After Installation: Provide substantial coverings as necessary to protect installed products from damage from traffic and subsequent construction operations. Remove covering when no longer needed.

H. The Contractor shall be responsible for all material, equipment and supplies sold and delivered to the Owner under this Contract until final inspection of the work and acceptance thereof by the Owner. In the event any such material, equipment and supplies are lost, stolen, damaged or destroyed prior to final inspection and acceptance, the Contractor shall replace same without additional cost to the Owner.

I. Should the Contractor fail to take proper action on storage and handling of equipment supplied under this Contract within seven (7) days after written notice to do so has been given, the Owner retains the right to correct all deficiencies noted in previously transmitted written notice and deduct the cost associated with these corrections from the Contractor's Contract. These costs may be comprised of expenditures for labor, equipment usage, administrative, clerical, engineering and any other costs associated with making the necessary corrections.

1.05 STORAGE AND HANDLING OF EQUIPMENT ON SITE

A. Special attention shall be given to the storage and handling of equipment on site. As a minimum, the procedure outlined below shall be followed:

1. Materials shall not be shipped until approved by the Engineer. The intent of this requirement is to avoid unnecessary delivery of unapproved materials and to reduce on-site storage time prior to installation and/or operation. Under no circumstances shall major equipment or finish products be delivered to the site more than one month prior to installation without written authorization from the Engineer. Materials shipped to the site, or temporarily stored off-site in approved locations, shall be stored in accordance with Paragraph 1.04, herein.

2. All equipment having moving parts such as gears, electric motors, etc. and/or instruments shall be stored in a temperature and humidity controlled building approved by the Engineer, until such time as the equipment is to be installed.

3. All equipment shall be stored fully lubricated with oil, grease, etc. unless otherwise instructed by the manufacturer.

4. Manufacturer's storage instructions shall be carefully studied by the Contractor and reviewed with the Engineer by him. These instructions shall be carefully followed and a written record of this kept by the Contractor.

5. Moving parts shall be rotated a minimum of once weekly to insure proper lubrication and to avoid metal-to-metal “welding". Upon installation of the equipment, the Contractor shall start the equipment, at least at half load, once weekly for an adequate period of time to insure that the equipment does not deteriorate from lack of use.

6. Lubricants shall be changed upon completion of installation and as frequently as required thereafter during the period between installation and acceptance. Mechanical equipment to be used in the work, if stored for longer than ninety (90) days, shall have the bearings cleaned, flushed and lubricated prior to testing and startup, at no extra cost to the Owner.

7. Prior to acceptance of the equipment, the Contractor shall have the manufacturer inspect the equipment and certify that its condition has not been detrimentally affected by the long storage period. Such certifications by the manufacturer shall be deemed to mean that the equipment is judged by the manufacturer to be in a condition equal to that of equipment that has been shipped, installed, tested and accepted in a minimum time period. As such, the manufacturer will guarantee the equipment equally in both Instances. If such a certification is not given, the equipment shall be judged to be defective. It shall be removed and replaced at the Contractor's expense.

1.06 SPARE PARTS

A. Spare parts for certain equipment have been specified in the pertinent sections of the Specifications. The Contractor shall collect and store all spare parts so required in an area to be designated by the Engineer. In addition, the Contractor shall furnish to the Engineer an inventory listing all spare parts, the equipment they are associated with, the name and address of the supplier, and the delivered cost of each item. Copies of actual invoices for each item shall be furnished with the inventory to substantiate the delivered cost.

1.07 GREASE, OIL AND FUEL

A. All grease, oil and fuel required for testing of equipment shall be furnished with the respective equipment. The Owner shall be furnished with a year's supply of required lubricants including grease and oil of the type recommended by the manufacturer with each item of equipment supplied.

B. The Contractor shall be responsible for changing the oil in all drives and intermediate drives of each mechanical equipment after initial break-in of the equipment, which in no event shall be any longer than three (3) weeks of operation.

PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION (NOT APPLICABLE)

END OF SECTION

SECTION 01650

START-UP

PART 1 - GENERAL

1.01 DESCRIPTION

A. Scope of Work: Demonstrate to Owner and Engineer that the Work functions as a complete and operable system under normal and emergency operating conditions.

B. Contractor shall provide all materials, personnel, equipment and expendables as needed and as specified to perform the required start-up and demonstration tests.

C. Related Work Described Elsewhere:

1. Progress Schedules: Section 01300.

2. Operating and Maintenance Data: Section 01730.

3. Other technical specifications: Divisions 02 through 16

PART 2 - PRODUCTS

2.01 START-UP PLAN

A. Submit for approval by the Engineer a detailed start-up plan outlining the schedule and sequence of all tests and· start-up activities, including submittal of checkout forms, submittal of demonstration test procedures, start-up, demonstration and testing, submittal of certification of completed demonstration and training. Start-up and commissioning may not begin until the plan is approved by the Engineer.

PART 3 - EXECUTION

3.01 COMPONENT TEST AND CHECK-OUT

A. Start-up Certification: Prior to system start-up, successfully complete all the testing required of the individual components of the Work. Submit six (6) copies of CHECK-OUT MEMO'S for each individual component or piece of equipment, signed by the Contractor or the subcontractor and the manufacturer's representative.

B. All copies of the Operation and Maintenance Manuals must be provided before start-up may begin. These forms shall be completed and submitted before Instruction in Operation to Owner or a request for initiating any final inspections. Insert one (1) copy of this form into the applicable section of each Operation and Maintenance Manual.

C. Demonstrate to the Engineer and the Owner's representative, that all temporary jumpers and/or bypasses have been removed and that all of the components are operating under their own controls as designated.

D. Coordinate start-up activities with the Owner's operating personnel at the treatment plant site and with the Engineer prior to commencing system start-up.

3.02 START-UP

A. Confirm that all equipment is properly energized, that the valves are set to their normal operating condition and that the flow path through the new Work is unobstructed.

B. Slowly fill each hydrostatic structure in the process flow stream with water.

C. Initiate start-up and training in accordance with and with the use of the plant operation and maintenance manuals.

D. Observe the component operation and make adjustments as necessary to optimize the performance of the Work.

E. Coordinate with Owner for any adjustments desired or operational problems requiring debugging.

F. Make adjustments as necessary.

3.03 START-UP DEMONSTRATION AND TESTING

A. After all Work components have been constructed, field tested, and started up in accordance with the individual Specifications and manufacturer requirements, and after all Check-Out Forms have been completed and submitted, perform the Startup Demonstration and Testing. The demonstration period shall be held upon completion of all systems at a starting date to be agreed upon in writing by the Owner or his representative. Prior to beginning the start-up demonstration testing, the Contractor shall submit a detailed schedule of operational circumstances for approval by the Engineer. The schedule of operational circumstances shall describe, in detail, the proposed test procedures for each piece of equipment. Provide similar test procedure forms for each piece of equipment or section of the Work to include all particular aspects and features of that equipment or section of the Work and as specified in the Technical Sections of the Specifications.

B. The Start-Up Demonstration Testing will be conducted for five (5) consecutive days. The Work must operate successfully during the five (5) day testing period in the manner intended. If the Work does not operate successfully, or if the start-up is interrupted due to other contracts, the problems will be corrected and the test will start over from day one~ The party causing the interruption will be subject to the assessment of actual damages due to delay.

C. During the start-up demonstration period, operate the Work, instruct designated plant operating personnel in the function and operation of the Work, and cause various operational circumstances to occur. As a minimum, these circumstances will include average and peak daily flows, random equipment or process failures, tank overflows, surcharges, interlocks and bypasses. Demonstrate the essential features of the equipment and its relationship to other equipment. The approved schedule of operational circumstances and Demonstration Test Procedures Forms will be used as the agenda during the Start-Up Demonstration Testing period for all equipment and sections of the Work. Coordination of the demonstration test schedule will be accomplished through the Engineer.

D. Acceptability of the Work's performance will be based on the Work performing as specified under these actual and simulated operating conditions, to provide water treatment facilities functioning as intended and as defined in the Contract Documents. The intent of the start-up demonstration and testing is for the Contractor to demonstrate to the Owner and the Engineer that the Work will function as a complete and operable system under normal, as well as emergency operating conditions, and is ready for final acceptance.

E. Demonstrate the essential features of all the mechanical systems including, but not limited to, the following as they apply to the Work. Each system shall be demonstrated once only, after completion of testing.

F. Demonstrate the essential features of all electrical and instrumentation systems including, but not limited to, the following as they apply to the work:

1. Electrical systems controls and equipment.

    a. Electrical power equipment.

    b. Motor control centers.

    c. Motor control devices.

    d. Relays.

    e. Special transformers.

    f. Starting devices.

2. Supervisory control and data acquisition system.

3. Communications systems.

4. Lighting fixtures (including relamping and replacing lenses).

    a. Exit and safety fixtures.

    b. Fixtures, indoor and outdoor.

    c. Floodlighting.

5. Panel boards.

    a. Distribution panels.

    b. Lighting panels.

    c. Main panels, power panels.

    d. Switchboard.

6. Transfer switch (manual or automatic).

7. Wiring devices.

    a. Face plates.

    b. Low-voltage controls.

    c. Outlets: convenience, special purpose.

    d. Switches: regular, time.

G. Upon successful completion of the Start-up, Demonstration and Testing, the Owner's personnel will receive the specified training for each system. Training of the Owner's personnel will not be considered valid unless it takes place using a system that has successfully passed the Start-up, Demonstration and Testing.

H. Upon completion of all specified operator training, the Contractor shall submit to the Engineer six (6) copies of the Certificate of Completed Demonstration Form, for each item of equipment or system in the Work, signed by the Contractor, Subcontractor, Engineer, and the Owner. Insert one (1) copy of this form in the applicable section of each Operation and Maintenance Manual.

END OF SECTION

SECTION 01701

PROJECT CLOSEOUT

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Administrative and procedural requirements for project closeout.

1. Inspection procedures.

2. Project record document submittal.

3. Final cleaning.

1.02 SUBSTANTIAL COMPLETION

A. Before requesting inspection for certification of Substantial Completion, complete the following. List exceptions in the request.

1. If 100 percent completion cannot be shown, include a list of incomplete items, the value of incomplete construction, and reasons the Work is not complete.

2. Advise Owner of pending insurance change-over requirements.

3. Submit specific warranties, workmanship bonds, maintenance agreements, final certifications and similar documents - refer to Section 01740.

4. Obtain and submit releases enabling the Owner unrestricted use of the Work and access to services and utilities; include occupancy permits, operating certificates and similar releases.

5. Submit record drawings, maintenance manuals, and similar final record information.

6. Complete start-up testing of systems, and instruction of the Owner's operating and maintenance personnel. Discontinue or change over and remove temporary facilities from the site, along with construction tools, mock-ups, and similar elements.

7. Complete final clean up requirements, including touch-up painting. Touch-up and otherwise repair and restore marred exposed finishes.

B. When the Contractor considers the Work to be substantially complete, he shall submit a written notice to the Engineer that the Work, or designated portion of the Work, is complete and ready for inspection.

C. Within 5 days of receipt of a request for inspection, the Engineer will either proceed with inspection or advise the Contractor of unfulfilled requirements. When the Engineer and Owner concur that the Work, or designated portion of the Work, is substantially complete, the Engineer will prepare the Certificate of Substantial Completion following inspection.

D. Should the Engineer determine that the Work is not substantially complete, he will advise the Contractor of construction or other requirements that must be completed or corrected before the certificate will be issued.

1. The Engineer will repeat inspection when requested and assured that the Work has been substantially completed.

2. Results of the completed inspection will form the basis of requirements for final acceptance.

1.03 FINAL COMPLETION

A. When Contractor considers the Work to be complete, he shall submit written certification to the Engineer that the Work is completed and ready for final inspection. Include the following:

1. Submit the final payment request with releases and supporting documentation not previously submitted and accepted. Include certificates of insurance for products and completed operations.

2 Submit an updated final statement, accounting for final additional changes to the Contract Sum.

3. Submit a certified copy of the Engineer's final inspection list of items to be completed or corrected, stating that each item has been completed or otherwise resolved for acceptance, and the list has been endorsed and dated by the Engineer.

4. Submit final meter readings for utilities, a measured record of stored fuel, and similar data as of the date of Substantial Completion, or when the Owner took possession of and responsibility for corresponding elements of the Work.

5. Submit consent of surety to final payment.

6. Submit evidence of final, continuing insurance coverage complying with insurance requirements.

B. The Engineer will inspect the Work upon receipt of notice that the Work, including inspection list items from earlier inspections, has been completed, except items whose completion has been delayed because of circumstances acceptable to the Engineer.

1. Upon completion of inspection, the Engineer will prepare a certificate of final acceptance, or advise the Contractor of Work that is incomplete, or of obligations that have not been fulfilled but are required for final acceptance.

2. If necessary, reinspection process will be repeated.

1.04 RECORD DOCUMENT/ASBUILT SUBMITTALS

A. Requirements of JEA Water & Sewer Standards - AS-BUILT DRAWINGS - SECTION 501 shall govern for production of Asbuilts on this project. The following is supplemental requirements for asbuilts. In case of conflict between the JEA Water and Wastewater Standards and this section, comply with JEA Standards.

B. Maintain at the site one complete set of record documents; protect from deterioration and loss in a secure, fire-resistive location.

1. Provide access to record documents for the Engineer's reference during normal working hours.

2. Label each document "PROJECT RECORD" in 2-inch high printed letters.

3. Do not use for construction purposes.

B. Record Drawings: Maintain a clean, undamaged set of blue or black line white-prints of Contract Drawings and Shop Drawings. Mark the set to show the actual installation where the installation varies substantially from the Work as originally shown. Mark whichever drawing is most capable of showing conditions fully and accurately; where Shop Drawings are used, record a cross-reference at the corresponding location on the Contract Drawings. Give particular attention to concealed elements that would be difficult to measure and record at a later date.

1. Mark record sets with red erasable pencil; use other colors to distinguish between variations in separate categories of the Work.

2. Mark new information that was not shown on Contract Drawings or Shop Drawings.
3. Show elevations and horizontal control dimensions of storm sewers, gravity sewers including laterals, electric cables, television cables, telephone cables, force mains, water mains crossed, and any other underground utilities and structures. Information shall be obtained by surveying by a professional engineer or land surveyor registered in the State of Florida.

4. Note related Change Order numbers where applicable.

5. Organize record drawing sheets into manageable sets, bind with durable paper cover sheets, and print suitable titles, dates and other identification on the cover of each set.

C. Record Specifications: Maintain one complete copy of the Project Manual, including addenda, and one copy of other written construction documents such as Change Orders and modifications issued in printed form during construction.

1. Mark these documents to show substantial variations in actual Work performed in comparison with the text of the Specifications and modifications.

2. Give particular attention to substitutions, selection of options and similar information on elements that are concealed or cannot otherwise be readily discerned later by direct observation.

3. Note related record drawing information and Product Data.

D. Record Product Data: Maintain one copy of each Product Data submittal.

1. Mark these documents to show significant variations in actual Work performed in comparison with information submitted. Include variations in products delivered to the site, and from the manufacturer's installation instructions and recommendations.

2. Give particular attention to concealed products and portions of the Work which cannot otherwise be readily discerned later by direct observation.

3. Note related Change Orders and mark-up of record drawings and Specifications.

E. Record Sample Submitted: Immediately prior to the date or dates of Substantial Completion, the Contractor will meet at the site with the Engineer and the Owner to determine which of the submitted Samples that have been maintained during progress of the Work are to be transmitted to the Owner for record purposes. Comply with delivery to the Owner's Sample storage area.

F. Record Survey: Provide as-built survey prepared in accordance with the minimum technical standards for surveying as set forth by the Florida Board of Professional Surveyors and Mappers in Chapter 61G17-6 Florida Administrative Code, pursuant to Section 472.027 Florida Statutes.

G. Miscellaneous Record Submittals: Refer to other Specification Sections for requirements of miscellaneous record-keeping and submittals in connection with actual performance of the Work.

H. At Contract close-out, deliver one copy of Record Documents to Engineer for Owner. Accompany submittal with transmittal letter in duplicate containing the following information:

1. Date.

2. Project title and number.

3. Contractor's name and address.

4. Title and number of each Record Document.

5. Signature of Contractor or his authorized representative.

PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION

3.01 FINAL CLEANING

A. Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to the condition expected in a normal, commercial building cleaning and maintenance program.

B. Complete the following cleaning operations before requesting inspection for Certification of Substantial Completion and maintain until final completion, except in areas occupied or designated by Owner.

1. Remove labels that are not permanent labels.

2. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compound and other substances that are noticeable vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials.

3 Clean exposed exterior and interior hard-surfaced finishes to a dust-free condition, free of stains, films and similar foreign substances. Restore reflective surfaces to their original reflective condition.

4. Leave concrete floors broom clean.

5. Vacuum carpeted surfaces.

6. Wipe surfaces of mechanical and electrical equipment. Remove excess lubrication and other substances.

7. Clean plumbing fixtures to a sanitary condition.

8. Clean light fixtures and lamps.

9. Clean the site, including landscape development areas, of rubbish, litter and other foreign substances.

10. Sweep paved areas broom clean; remove stains, spills and other foreign. deposits.

11. Rake grounds that are neither paved nor planted, to a smooth even-textured surface.

C. Engage an experienced exterminator to make a final inspection and rid the Project of rodents, insects and other pests.

D. Remove temporary protection and facilities installed for protection of the Work during construction.

E. Comply with regulations of authorities having jurisdiction and safety standards for cleaning. Do not burn waste materials. Do not bury debris or excess materials on the Owner's property. Do not discharge volatile, harmful or dangerous materials into drainage systems. Remove waste materials from the site and dispose of in a lawful manner.

F. Where extra materials of value remaining after completion of associated Work have become the Owner's property, arrange for disposition of these materials as directed.

END OF SECTION

SECTION 01730

OPERATING AND MAINTENANCE DATA

PART 1 - GENERAL

1.01 DESCRIPTION

A. Scope of Work:

1. Compile product data and related information appropriate for Owner's maintenance and operation of products furnished under Contract.

    a. Prepare operating and maintenance data as specified JEA Specification – Pump Station Operation and Maintenance Data Submission Requirements – Section 445 and as referenced in this Section (if deviation use JEA Standards).

2. Instruct Owner's personnel in maintenance of products and in operation of equipment and systems.

B. Related Requirements Described Elsewhere:

1. JEA Specification – Pump Station Operation and Maintenance Data Submission Requirements – Section 445

2. Project Closeout: Section 01701

3. Project Record Documents: Section 01701

4. Equipment: See contract plans

5. Electrical, Instrumentation and Controls: Division 16 Electrical

6. Mechanical: Divisions 2 through 15

1.02 QUALITY ASSURANCE

A. Preparation of data shall be done by personnel:

1. Trained and experienced in maintenance and operation of described products.

2. Familiar with requirements of this Section.

3. Skilled as technical writer to the extent required to communicate essential data.

4. Skilled as draftsmen competent to prepare required drawings.

1.03 FORM OF SUBMITTALS

A. Prepare data in form of an instructional manual for use by Owner's personnel.

B. Electronic Format – Submit manual in the form of paragraph C. Hardcopy Format, on CDROM(s) in Adobe Portable Document Format (pdf).

C. Hardcopy Format:

1. Size: 8-1/2 inches x 11 inches.

2. Paper: 20 pound minimum, white, for typed pages.

3. Text: Manufacturer's printed data, or neatly typewritten.

4. Drawings:

    a. Provide reinforced punched binder tab, bind in with text.

    b. Reduce larger drawings and fold to size of text pages but not larger than 11 inches x 17 inches landscape.

5. Provide fly-leaf for each separate product, or each piece of operating equipment.

    a. Provide typed description of projects and major component parts of equipment.

    b. Provide identification tabs.

6. Cover shall contain the following information:

    a. Identify each volume with typed or printed title "OPERATING AND MAINTENANCE INSTRUCTIONS".

    b. Title of Project.

    c. Identity of separate structure as applicable.

    d. Identity of general subject matter covered in the manual.

D. Binders:

1. Commercial quality, three D-ring type binders with durable and cleanable white plastic covers. Binders shall be presentation type with clear vinyl covers on front, back and spine. Binders shall include two sheet lifters and two, horizontal inside pockets.

2. Maximum D-ring width: 2 inches.

3. When multiple binders are used, correlate the data into related consistent groupings.

E. Graphics Requirements

1. In addition to standard operation and maintenance manuals, all manufacturers supplying equipment specified in Divisions 11, 13, 15, and 16 shall submit their

operation and maintenance manuals on CDROM in Microsoft Word format. All graphic files shall be in BMP, PNG, JPEG, DWG or DXF formats.

1.04 CONTENT OF MANUAL

A. Neatly typewritten table of contents for each volume, arranged in systematic order.

1. Contractor, name of responsible principal, address and telephone number.

2. A list of each product required to be included, indexed to content of the volume.

3. List, with each product, name, address and telephone number of:

a. Subcontractor, manufacturer and installer name, addresses and telephone numbers.

b. A list of each product required to be included, indexed to content of the volume.

c. Identify area of responsibility of each.

d. Local source of supply for parts and replacement equipment including name, address and telephone number.

4. Identify each product by product name and other identifying symbols as set forth in Contract Documents.

B. Product Data:

1. Include only those sheets which are pertinent to the specific product.

2. Annotate each sheet to:

a. Clearly identify specific product or part installed.

b. Clearly identify data applicable to installation.

c. Delete references to inapplicable information.

3. Operation and maintenance information as herein specified.

4. Record shop drawings as submitted and approved with all corrections made for each product.

C. Drawings:

1. Supplement product data with drawings as necessary to clearly illustrate:

a. Relations of component parts of equipment and systems.

b. Control and flow diagrams.

2. Coordinate drawings with information in Project Record Documents to assure correct illustration of completed installation.

3. Do not use Project Record Documents as maintenance drawings.

D. Written test, as required to supplement product data for the particular installation:

1. Organize in consistent format under separate headings for different procedures.

2. Provide logical sequence of instruction of each procedure.

E. Copy of each warranty, bond and service contract issued.

1. Provide information sheet for Owner's personnel. Information sheet shall include:

a. Proper procedures to follow in event of failure.

b. Instances which might affect validity of warranties or bonds.

1.05 MANUAL FOR MATERIALS AND FINISHES

A. Submit six (6) copies of complete manual in final form.

B. Content: for architectural products, applied materials and finishes:

1. Manufacturer's data, giving full information on products.

a. Catalog number, size, and composition.

b. Color and texture designations.

c. Information required for reordering special manufacturing products.

2. Instructions for care and maintenance.

a. Manufacturer's recommendation for types of cleaning agents and methods.

b. Cautions against cleaning agents and methods which are detrimental to product.

c. Recommended schedule for cleaning and maintenance.

C. Content, for moisture protection and weather-exposed products:

1. Manufacturer's data, giving full information on products.

a. Applicable standards.

b. Chemical composition.

c. Details of installation.

2. Instructions for inspection, maintenance and repair.

D. Additional requirements for maintenance data: Respective sections of Specifications.

1.06 MANUAL FOR EQUIPMENT AND SYSTEMS

A. Submit six (6) copies of complete manual in final form.

B. Content, for each unit of equipment and system, as appropriate:

1. Description of unit and component parts.

    a. Function, normal operating characteristics, and limiting conditions.

    b. Performance curves, engineering data and tests.

    c. Complete nomenclature and commercial number of replaceable parts.

    d. Summary of information listed on equipment and motor data plates.

2. Operating procedures:

    a. Start-up, break-in, routine and normal operating instructions.

    b. Regulation, control, stopping, shut-down and emergency instructions.

    c. Summer and winter operating instructions.

    d. Special operating instructions.

3. Maintenance procedures:

    a. Routine operations.

    b. Guide to "trouble-shooting".

    c. Disassembly, repair and reassembly.

    d. Alignment, adjusting and checking.

4. Servicing and lubrication required.

5. Manufacturer's printed operating and maintenance instructions.

6. Description of sequence of operation by control manufacturer.

7. Original manufacturer's parts list, illustrations, assembly drawings and diagrams required for maintenance.

    a. Predicted life of parts subject to wear.

    b. Items recommended to be stocked as spare parts.

8. As-installed control diagrams by controls manufacturer.

9. Each Contractor's coordination drawings.

    a. As-installed color coded piping diagrams.

10. Charts of valve tag numbers, with location and function of each valve.

11. List of original manufacturer's spare parts, manufacturer's current prices and recommended quantities to be maintained in storage.

12. Other data as required under pertinent sections of specifications.

13. Approved record shop drawings with all corrections made, and a copy of the warranty statement, checkout memo, demonstration test procedures and demonstration test certification.

C. Content, for each electric and electronic systems, as appropriate:

1. Description of system and component parts.

    a. Function, normal operating characteristics, and limiting conditions.

    b. Performance curves, engineering data and tests.

    c. Complete nomenclature and commercial number of replaceable parts.

2. Circuit directories and panel boards.

    a. Electrical service.

    b. Controls.

    c. Communications.

3. As-installed color coded wiring diagrams.

4. Operating procedures:

    a. Routine and normal operating instructions.

    b. Sequences required.

    c. Special operating instructions.

5. Maintenance procedures:

    a. Routine operations.

    b. Guide to "trouble-shooting".

    c. Disassembly, repair and reassembly.

    d. Adjustment and checking.

6. Manufacturer's printed operating and maintenance instructions.

7. List of original manufacturer's spare parts, manufacturer's current prices, and recommended quantities to be maintained in storage.

8. Other data as required under pertinent sections of specifications.

D. Prepare and include additional data when the need for such data becomes apparent during instruction of Owner's personnel.

E. Additional requirements for operating and maintenance data: Respective sections of Specifications.

1.07 SUBMITTAL SCHEDULE

A. Submit two (2) copies of preliminary draft of proposed formats and outlines of contents of Operation and Maintenance Manuals within 90 days after Notice to Proceed.

B. Submit two (2) copies of completed data in preliminary form no later than 20 days following Engineer's review of the last shop drawing of a product and/or other submittal specified under Section 01340, but no later than delivery of equipment. One (1) copy will be returned with comments to be incorporated into the final copies and the other copy will be retained on-site for use in any early training.

C. Submit six (6) copies of approved manual in final form directly to the offices of the Engineer within 10 days after the reviewed copy or last item of the reviewed copy is returned.

D. Provide six (6) copies of addenda to the operation and maintenance manuals as applicable and certificates as specified within 30 days after final inspection.

1.08 INSTRUCTION OF OWNER'S PERSONNEL

A. Prior to demonstration test, fully instruct Owner's designated operating and maintenance personnel in operation, adjustment and maintenance of products, equipment and systems.

B. Operating and maintenance manual shall constitute the basis of instruction.

Review contents of manual with Owner's operating and maintenance personnel in full detail to explain all aspects of operations and maintenance.

C. Instructors shall be fully qualified personnel as outlined within the individual equipment specifications. If no specific training specifications are listed with the equipment, the Contractor shall provide the instruction with qualified Contractor personnel.

D. The Contractor shall provide a list to the Owner indicating the date, time and instructors that will be present for all training sessions.

E. The instructors shall provide for and prepare lesson scopes and handouts for up to five individuals designated by the Owner that outline the items to be covered. Separate sessions for operation and maintenance instruction shall be provided consecutively.

Handouts shall be submitted to the Owner with at least one week's notice prior to the training sessions.

F. All instruction sessions shall be video recorded with portable video recording cameras and disks supplied by the Contractor. Video recording shall be made by the Contractor under the direction of the Owner using video recording equipment.

PART 2 – PRODUCTS (NOT APPLICABLE)

PART 3 – EXECUTION (NOT APPLICABLE)

END OF SECTION

SECTION 01740

WARRANTIES AND BONDS

PART 1 - GENERAL

1.01 RELATED REQUIREMENTS

A. General provisions of Contract, including General and Supplementary Conditions.

B. Warranties and certificates for specific products - Respective Plans/Specification Sections.

C. Project closeout - Section 01701.

D. Operating and maintenance data - Section 01730.

1.02 SECTION INCLUDES

A. Administrative and procedural requirements for warranties, bonds, and certifications required by the Contract Documents, including manufacturers standard warranties on products and special warranties.

1.03 WARRANTY REQUIREMENTS

A. When correcting warranted Work that has failed, remove and replace other Work that has been damaged as a result of such failure or that must be removed and replaced to provide access for correction of warranted Work.

B. When Work covered by a warranty has failed and been corrected by replacement or rebuilding, reinstate the warranty by written endorsement. The reinstated warranty shall be equal to the original warranty with an equitable adjustment for depreciation.

C. Upon determination that Work covered by a warranty has failed, replace or rebuild the Work to an acceptable condition complying with requirements of Contract Documents. The Contractor is responsible for the cost of replacing or rebuilding defective Work regardless of whether the Owner has benefited from use of the Work through a portion of its anticipated useful service life.

D. Written warranties made to the Owner are in addition to implied warranties, and shall not limit the duties, obligations, rights and remedies otherwise available under the law, nor shall warranty periods be interpreted as limitations on time in which the Owner can enforce such other duties, obligations, rights, or remedies.

E. The Owner reserves the right to reject warranties and to limit selections to products with warranties not in conflict with requirements of the Contract Documents.

F. The Owner reserves the right to refuse to accept Work for the Project where a special warranty, certification, or similar commitment is required on such Work or part of the Work, until evidence is presented that entities required to countersign such commitments are willing to do so.

1.04 SUBMITTALS

A. Submit written warranties to the Owner before requesting inspection for Substantial Completion. If the Owner's Certificate of Substantial Completion designates a commencement date for warranties other than the date of Substantial Completion for the Work, or a designated portion of the Work, submit written warranties upon request of the Owner.

B. When a designated portion of the Work is completed and occupied or used by the Owner, by separate agreement with the Contractor during the construction period, submit properly executed warranties to the Owner within fifteen days of completion of that designated portion of the Work.

C. When a special warranty is required to be executed by the Contractor, or the Contractor and a subcontractor, supplier or manufacturer, prepare a written document that contains appropriate terms and identification, ready for execution by the required parties. Submit a draft to the Owner for approval prior to final execution.

D. Provide written certifications of compliance and other commitments and agreements for continuing services in a form which includes all pertinent information including:

1. Quantities and dates of shipments.

2. Testament that materials incorporated into the Work comply with specified requirements. Certification shall not be construed as relieving the Contractor from furnishing satisfactory materials, if the material is later found to not meet specified requirements.

3. Signature of officer of company.

4. Laboratory test reports submitted with certificates of compliance shall show dates of testing, specification requirements under which testing was performed, and results of tests.

E. Refer to individual Sections of Divisions 2 through 16 for specific content requirements, and particular requirements for submittal of special warranties.

F. Form of Submittal:

1. Compile three (3) copies of each required warranty and bond properly executed by the Contractor, or by the Contractor, subcontractor, supplier, or manufacturer.

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

3. Bind warranties and bonds in heavy-duty, commercial quality, durable 3-ring vinyl covered loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2 in. by 11 in. paper.

4. Provide heavy paper dividers with celluloid covered tabs for each separate warranty. Mark the tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product, and the name, address and telephone number of the installer.

5. Identify each binder on the front and the spine with the typed or printed title "WARRANTIES AND BONDS", the Project title or name, and the name of the Contractor.

PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION (NOT APPLICABLE)

END OF SECTION

DIVISION 2

SITE WORK

SECTION 02050
DEMOLITION AND MODIFICATIONS

PART 1 GENERAL

1.01 SCOPE OF WORK

A. This specification is a supplement to JEA Specification - Demolition and Abandonment – Section 407. This specification provides specific details associated with this project. Refer to JEA specification for details of abandonment and removal of the demolition work described herein and on the plans.

B. Furnish all labor, materials, equipment and incidentals required and demolish, modify, remove and dispose of work shown on the Drawings and as specified herein.

C. Included, but not limited to, are demolition, modifications and removal of existing materials, equipment or work necessary to install the new work as shown on the Drawings and as specified herein and to connect with existing work in approved manner.

D. Demolition, modifications and removals which may be specified under other Sections shall conform to requirements of this Section.

E. Demolition and modifications include, but is not necessarily limited to, the following major items. Other, minor items are shown/detailed in the drawings and other specification sections:

1. Paving/Grading – Remove existing asphalt paving as shown. Provide new paving and subbase (where required) and finish grading as shown.

2. Remove and replace (in either the same or new location, as shown) the following
   a. Vertical wastewater pumps
   b. Seal water system
   c. Flushing water booster pump
   d. Electrical equipment
   e. Instrumentation

3. Remove, repair (as required), prime and recoat interior walls, ceilings and floors as shown and specified.

F. Blasting and the use of explosives will not be permitted for any demolition work.

1.02 RELATED WORK

A. JEA Specification - Demolition and Abandonment – Section 407.

B. Summary of Work: Section 01010.

C. Submittals: Section 01300.

D. Construction Sequence: Section 01014.

E. Site clearing: Section 02110.

F. Earthwork: Section 02222.

G. Regulatory Requirements: Section 01060.

1.03 SUBMITTALS

A. Submit, in accordance with Section 01300, six copies of proposed methods and operations of demolition of the structures and modifications prior to the start of work. Include in the schedule the coordination of shutoff, capping and continuation of utility service as required.

B. Furnish a detailed sequence of demolition and removal work to ensure the uninterrupted progress of the Owner's operations. Sequence shall be compatible with sequence of construction and shutdown coordination requirements as specified in Section (01014).

C. Before commencing demolition work, all modifications necessary to bypass the affected structure shall be completed. Actual work shall not begin until the Engineer has inspected and approved the modifications and authorized commencement of the demolition work in writing.

1.04 JOB CONDITIONS

A. Protection

1. Execute the demolition and removal work to prevent damage or injury to structures, occupants thereof and adjacent features which might result from falling debris or other causes, and so as not to interfere with the use, and free and safe passage to and from adjacent structures.

2. Closing or obstructing of roadways, sidewalks and passageways adjacent to the work by the placement or storage of materials will not be permitted and all operations shall be conducted with a minimum interference to traffic on these ways.

3. Erect and maintain barriers, lights, sidewalk sheds and other required protective devices.

B. Scheduling

1. Carry out operations so as to avoid interference with operations and work in the existing facilities.

C. Notification

1. At least 48 hours prior to commencement of a demolition or removal, notify the Engineer in writing of proposed schedule therefor. Owner shall inspect the existing equipment and to identify and mark those items which are to remain the property of the Owner. No removals shall be started without the permission of the Engineer.

D. Conditions of Structures

1. The Owner and the Engineer assume no responsibility for the actual condition of the structures to be demolished or modified.

2. Conditions existing at the time of inspection for bidding purposes will be maintained by the Owner insofar as practicable. However, variations within a structure may occur prior to the start of demolition work.

E. Repairs to Damage

1. Promptly repair damage caused to adjacent facilities by demolition operation when directed by Engineer and at no additional cost to the Owner. Repairs shall be made to a condition at least equal to that which existed prior to construction.

F. Traffic Access

1. Conduct demolition and modification operations and the removal of equipment and debris to ensure minimum interference with roads, streets, walks both onsite and offsite and to ensure minimum interference with occupied or used facilities.

2. Special attention is directed towards maintaining safe and convenient access to the existing facilities by plant personnel and plant associated vehicles.

3. Do not close or obstruct streets, walks or other occupied or used facilities without permission from the Engineer. Furnish alternate routes around closed or obstructed traffic in access ways.

1.05 DISPOSAL OF MATERIAL

A. Salvageable material and equipment listed hereinafter shall become the property of the Owner. Dismantle all such items to a size that can be readily handled and deliver them to a designated storage area.

1. No salvageable materials.

B. All other material and items of equipment shall become the Contractor's property and must be removed from the site.

C. The storage or sale of removed items on the site will not be allowed.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 GENERAL

A. All materials and equipment removed from existing work shall become the property of the Contractor, except for those which the Owner has identified and marked for his/her use. All materials and equipment marked by the Owner to remain shall be carefully removed, so as not to be damaged, cleaned and stored on or adjacent to the site in a protected place specified by the Engineer or loaded onto trucks provided by the Owner.

B. Dispose of all demolition materials, equipment, debris and all other items not marked by the Owner to remain, off the site and in conformance with all existing applicable laws and regulations.

C. Pollution Controls

1. None

D. Structure Demolition

1. Unless otherwise approved by Engineer, proceed with demolition from the top of the structure to the ground.

2. Demolish concrete and masonry in small sections.

3. Remove structural framing members and lower to ground by means of hoists, derricks, or other suitable methods.

4. Break up and remove foundations and slabs-on-grade, unless otherwise shown to remain.

5. Locate demolition equipment throughout the structure and remove material so as to not impose excessive loads to supporting walls, floors or framing.

3.02 STRUCTURAL REMOVALS

A. Remove structures to the lines and grades shown unless otherwise directed by the Engineer. Where no limits are shown, the limits shall be 4-in outside the item to be installed. The removal of masonry beyond these limits shall be at the Contractor's expense and these excess removals shall be reconstructed to the satisfaction of the Engineer with no additional compensation to the Contractor.

B. All concrete, brick, tile, concrete block, roofing materials, reinforcement, structural or miscellaneous metals, plaster, wire mesh and other items contained in or upon the structure shall be removed and taken from the site, unless otherwise approved by the Engineer. Demolished items shall not be used in backfill adjacent to structures or in pipeline trenches.

C. After removal of parts or all of masonry walls, slabs and like work which tie into new work or existing work, the point of junction shall be neatly repaired so as to leave only finished edges and surface exposed.

3.03 MECHANICAL REMOVALS

A. Mechanical removals shall consist of dismantling and removing of existing piping, pumps, motors, equipment and other appurtenances as specified, shown, or required for the completion of the work. It shall include cutting, capping, and plugging as required, except that the cutting of existing piping for the purpose of making connections thereto will be included under Division 15.

B. Existing process, water, chemical, gas, fuel oil and other piping not required for the new work shall be removed where shown or where it will interfere with new work. Piping not indicated to be removed or which does not interfere with new work shall be removed to the nearest solid support, capped and left in place. Chemical and fuel lines and tanks shall be purged and made safe prior to removal or capping. Where piping that is to be removed passes through existing walls, it shall be cut off and properly capped on each side of the wall.

C. When underground piping is to be altered or removed, the remaining piping shall be properly capped. Abandoned underground piping may be left in place unless it interferes with new work or is shown or specified to be removed.

D. Waste and vent piping shall be removed to points if shown on the plans. Pipe shall be plugged with cleanouts and plugs. Where vent stacks pass through an existing roof that is to remain, they shall be removed and the hole in the roof properly patched and made watertight.

E. Any changes to potable water piping and other plumbing and heating system work shall be made in conformance with all applicable codes and under the same requirements as other underground piping. All portions of the potable water system that have been altered or opened shall be pressure tested and disinfected in accordance with applicable JEA standards, local and state codes. Other plumbing piping and heating piping shall be pressure tested only.

3.04 ELECTRICAL REMOVALS

A. Electrical removals shall consist of the removal of existing transformers, distribution switchboards, control panels, motors, conduits and wires, poles and overhead wiring, panel boards, lighting fixtures and miscellaneous electrical equipment all as shown on the electrical or mechanical drawings, specified herein, or required to perform the work.

B. All existing electrical equipment and fixtures to be removed shall be removed with such care as may be required to prevent unnecessary damage, to keep existing systems in operation and to maintain the integrity of the grounding systems.

C. Conduits and wires shall be abandoned or removed where shown. All wires in abandoned conduits shall be removed, salvaged and stored. Abandoned conduits concealed in floor or ceiling slabs or in walls, shall be cut flush with the slab or wall at the point of entrance. The conduits shall be suitable plugged and the area repaired in a flush, smooth and approved manner. Exposed conduits and their supports shall be disassembled and removed from the site. Repair all areas of work to prevent rust spots on exposed surfaces.

D. Where shown or otherwise required, wiring in the underground duct system shall be removed. All such wiring shall be salvaged and stored as specified. Verify the function of all wiring before disconnection and removing it. Ducts which are not to be reused shall be plugged where they enter buildings and made watertight.

E. Where shown, direct-burial cable shall be abandoned. Such cable shall be disconnected at both ends of the run. Where it enters a building or structure the cable

shall be cut back to the point of entrance. All opening in buildings for entrance of abandoned direct-burial cable shall be patched and made watertight.

F. Poles and overhead wiring shall be abandoned as shown and specified. Existing substation and poles owned by the power company will be removed by the power company. Poles not owned by the power company shall be completely removed from the site. The overhead wires shall be salvaged and stored. Perform this work after the proposed service has been completed and energized, and in accordance with the approved schedule.

G. Lighting fixtures shall be removed or relocated as shown. Fixtures not relocated shall be removed from the site. Relocated fixtures shall be carefully removed from their present location and rehung where shown.

H. Wall switches, receptacles, starters and other miscellaneous electrical equipment, shall be removed and disposed of off the site as required. Care shall be taken in removing all equipment so as to minimize damage to architectural and structural members. Any damage incurred shall be repaired.

3.05 CLEAN-UP

A. Remove from the site all debris resulting from the demolition operations as it accumulates. Upon completion of the work, all materials, equipment, waste and debris of every sort shall be removed and premises shall be left, clean, neat and orderly.

END OF SECTION

SECTION 02110

SITE CLEARING

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. This specification is a supplement to JEA Specification – Clean Up and Restoration – Section 406.

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

1.2 DESCRIPTION OF WORK

A. Extent of site clearing is shown on drawings.

B. Site clearing work includes, but is not limited to:

1. Protection of existing trees not to be removed.

2. Removal of trees and other vegetation.

3. Topsoil stripping.

4. Clearing and grubbing.

5. Removing above-grade improvements.

6. Removing below-grade improvements.

C. Site Preparation - Section 02222.

1.3 JOB CONDITIONS

A. Traffic

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

B. Protection of Existing Improvements

1. Provide protections necessary to prevent damage to existing improvements indicated to remain in place.

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

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

C. Protection of Existing Trees and Vegetation

1. Protect existing trees and other vegetation indicated to remain in place, against unnecessary cutting, breaking or skinning of roots, skinning and bruising of bark.

    a. Repair or replace trees and vegetation indicated to remain which are damaged by construction operations, in a manner acceptable to Architect/Engineer. Employ licensed arborist to repair damages to trees and shrubs.

    b. Replace trees which cannot be repaired and restored to full-growth status, as determined by arborist.

D. Salvable Improvements

1. Carefully remove items indicated to be salvaged, and store on Owner's premises where indicated or directed.

PART 2 – PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION

3.1 SITE CLEARING

A. General

1. All site vegetation (i.e. trees and underbrush) within the planned construction areas shall be cleared, including their root systems and the surficial silty/organic topsoils. This clearing/stripping work shall be performed within and to a distance of at least five feet beyond the perimeter of the planned construction areas. The perimeter areas may then need to be graded to help direct surface water runoff away from the planned construction areas.

B. Topsoil

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

    a. Strip topsoil to whatever depths encountered in a manner to prevent intermingling with underlying subsoil or other objectionable material.

    b. Remove heavy growths of grass from areas before stripping.

    c. Where trees are indicated to be left standing, stop topsoil stripping a sufficient distance to prevent damage to the main root system.

    d. Stockpile topsoil in storage piles in areas shown, or where directed. Construct storage piles to freely drain surface water. Cover storage piles if required to prevent wind-blown dust. Dispose of unsuitable or excess topsoil same as waste material, herein specified.

C. Clearing and Grubbing

1. Clear site of trees, shrubs and other vegetation, except for those indicated to be left standing.

    a. Completely remove all surface vegetation, debris and other deleterious materials including root systems and the surficial silty/organic topsoils.

    b. Use only hand methods for grubbing inside the drip line of trees indicated to be left standing.

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

    d. Site preparation is detailed in Section 02222.

    e. Clearing/stripping work shall be performed within a distance of at least 5 feet beyond the perimeter of the construction area.

D. Removal of Improvements

1. Remove existing above-grade and below-grade improvements necessary to permit construction, and other work as indicated.

3.2 DISPOSAL OF WASTE MATERIALS

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

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

END OF SECTION

SECTION 02140

DEWATERING

PART 1 - GENERAL

1.1 Scope

A. In general, the work specified in this section of the Specifications shall consist of supplying labor, materials and equipment, and performing all work necessary to lower and control the groundwater levels and hydrostatic pressures to permit all excavations and construction specified under this Contract to be performed in the dry. .

1.2 Examination of the Site

A. The Contractor shall take all steps necessary to familiarize himself with the site conditions, the ground conditions and the groundwater conditions. It is expressly understood that neither the Owner's nor Owner's Representative will be held responsible for any interpretations or conclusions drawn by the Contractor.

PART 2 - PRODUCT

2.1 Method and Equipment

A. The Contractor may use any dewatering method he deems feasible so long as it results in working in stable soils conditions. It is the intent of these Specifications that an adequate dewatering system be installed to lower and control the groundwater in order to permit excavation, construction of the structures and the placement of the fill materials, all to be performed under dry conditions. The dewatering system shall be adequate to pre-drain the water bearing strata above and below the bottom of the foundations, sewers, water lines and all other excavations. An adequate weight of fill material shall be in place prior to discontinuing operation of dewatering to prevent buoyancy of any structure. All dewatering operations shall be in accordance with applicable requirements of authorities having jurisdiction, such as, but not limited to, St. Johns River Water Management District and Florida Department of Environmental Protection.

PART 3 - EXECUTION

3.1 General

A. The Contractor shall be solely responsible for arrangement, location and depths of the dewatering system necessary to accomplish the work described under this section of the Specifications. The dewatering shall be accomplished in a manner that will reduce the hydrostatic head below any excavation to the extent that the water level and piezometer water levels in the construction area are below the prevailing excavation surface; will prevent the loss of fines, seepage, boils, quick conditions, or

softening of the foundation strata; will maintain stability of the side and bottom of the excavation; and will result in all construction operations being performed in the dry. It is the Contractor's responsibility to prevent surface water and subsurface or ground water from flowing into excavations.

3.2 Disposal of Water

A. The Contractor shall promptly dispose of all water removed from the excavations in such a manner as will not endanger public health, damage public or private property, or affect adversely any portion of the work under construction or completed by him or any other Contractor. Contractor shall obtain written permission from the Owner of any property involved before digging ditches or constructing water courses for the removal of water. Contractor shall apply for and obtain at the Contractor's expense from all agencies having jurisdiction all permits required for disposal of water resulting from dewatering operations. Water shall not be discharged into streets, roadways, driveways, or private property.

B. Where excavation and dewatering occurs in soils containing clay, silt or other materials resulting in turbidity in excess of 29 NTU above background at the point of discharge, the Contractor shall provide for settling, filtering or other treatment to lower turbidity to this level. If the project contains stormwater retention and/or detention systems, the Contractor may temporarily use this area for treatment, by capping the bleed-down pipe, pumping discharge in the pond and allowing it to settle prior to discharge. Contractor may also construct a temporary detention/treatment pond. Use of alum and polymeric coagulation agents to aid in settling is allowed, providing that pH is adjusted prior to discharge. The Contractor shall submit his dewatering plan to the Engineer for approval if such additives are used, and submit pH test data to the Engineer showing no greater than 1 pH unit change from background in water to be discharged.

3.3 Inadequate System

A. If the dewatering requirements are not satisfied due to inadequacy or failure of the dewatering system, then loosening of the foundation strata, or instability of the slopes, or damage to the foundations or structures may occur. The supply of all labor, materials and equipment, and the performance of all work necessary to carry out additional work for reinstatement of the structures or foundation soil resulting from such inadequacy or failure shall be undertaken by the Contractor to the approval of the Owner's Representative, and at no additional expense the Owner.

END OF SECTION

SECTION 02222

BUILDING EARTHWORK

PART 1 – GENERAL

1.1 DESCRIPTION

A. This specification is a supplement to JEA Specification – Excavation and Earthwork – Section 408.

B. Section 02222 is intended for earthwork associated with the installation of the new precast concrete electrical building, exterior concrete vaults, equipment pads, concrete splitter box top replacement. It is NOT intended for earthwork associated with the installation of utility piping (refer to JEA Section 408 and applicable JEA piping specification).

C. Provide earthwork, including clearing and grubbing, excavation, fill, backfill and compaction for building areas and concrete walks and slabs, shown on the drawings and specified as required to complete work.

1.2 QUALITY ASSURANCE

A. Codes and Standards: Perform earthwork in compliance with applicable requirements of governing authorities having jurisdiction.

B. Testing and Inspection Service: Contractor shall employ and pay an independent soil testing and inspection service to perform a soil survey for satisfactory soil materials, sampling and testing for quality control during earthwork operations.

C. Test for Proposed Soil Materials:

1. Test soil materials proposed for use in the work and promptly submit test result reports.
2. Provided one optimum moisture-maximum density curve for each type of soil encountered in subgrade and fills under building foundations and slab areas. Determine maximum densities in accordance with ASTM D 1557, and ASTM D 4253, as applicable.
3. For borrow materials, perform a mechanical analysis, AASHTO-T88 plasticity index, AASHTO T91; moisture-density curve, AASHTO-T180 or ASTM D 1557.

1.3 SUBMITTALS

A. Test Reports: Submit two copies of the following reports to the Engineer:

1. Test report on borrow material.

2. Field density test reports.

3. Optimum moisture-maximum density curve for each type of soil encountered.

B. Submit Manufacturer's Literature for vibratory compaction equipment.

1.4 JOB CONDITIONS

A. Protection: Protect structures, utilities, sidewalks, pavements, and other facilities from damages caused by settlement, lateral movement, undermining, washout and other hazards created by excavation operations. Should any uncharted utilities be found, notify the utility company and Architect-Engineer immediately and await instructions before proceeding further with work in that location.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

A. Fill and Backfill Materials: Clean, free-draining sand (max. 10% passing the 200 mesh sieve) free from organic materials.

B. Excavated material conforming to requirements for fill and backfill material may be used for fill and backfill.

C. Provide additional fill material from off-site when required to complete the work.

2.2 VIBRATORY COMPACTION EQUIPMENT

A. Vibratory Rollers: The vibratory drum roller shall have the following minimum requirements:

1. Drum Roller: 48 inches.

2. Static Drum Weight: 6,000 to 8,000 lbs.

3. The Architect-Engineer prior to start of compaction operations shall approve the roller used.

4. Approved compactors include Galion, Dynapac and Bros.

5. Vibratory roller shall not be used within 30 feet of existing structures. Use mechanical hand tampers.

B. Mechanical Hand Tampers: Hand tampers shall be capable of meeting the compaction requirements specified herein.

PART 3 – EXECUTION

3.1 CLEARING AND GRUBBING BUILDING AREAS

A. Clear and grub the entire building area to at least 5 feet beyond perimeter of building footings and foundation, walks and slabs to remove stumps, roots, trees, vegetation, organic material and other obstructions to the work. Grub out all roots larger than 1/4 inch in diameter, matted roots and other organic material to at least 24 inches below existing surface.

B. Strip topsoil from areas within the building and slab areas and stockpile on the site for future use in site grading.

3.2 EXCAVATION

A. Excavate to depths and dimensions required for footings, slabs and structures. Remove and dispose of all obstructions to the work that are encountered above and below grade during excavation operations. Removal and disposal includes the following:

1. Stumps, roots, trees and other organic materials.
2. Pavement, foundations, concrete, and other inorganic materials.
3. Abandoned utilities and utilities indicated to be removed.
4. Organic and other unsuitable soil materials.

B. Stability of Excavations:

1. Slope the sides of excavation to comply with local codes and ordinances having jurisdiction. Shore and brace where sloping is not possible either because of space restrictions or stability of material excavated. Maintain sides and slopes of excavations in a safe condition until completion of backfilling.

2. Shoring and Bracing: Provide shoring and bracing to comply with local codes and authorities having jurisdiction.

C. Dewatering:

1. Prevent surface water and subsurface or groundwater from flowing into excavations and flooding the project site and surrounding area.

2. Do not allow water to accumulate in excavations. Provide dewatering system components necessary to convey the water away from excavations.

D. Excavation for Structures:

1. Conform to the elevations and dimensions shown on the drawings, with a tolerance of plus or minus 0.10 ft., and extending a sufficient distance from footings and foundations to permit placing and removal of

concrete formwork, installation of services, other construction, and for inspection.

2. In excavating for footings and foundations, take care not to disturb bottom of the excavation. Excavate by hand to final grade just before concrete reinforcement is placed. Trim bottoms to the required lines and grades to leave a solid base to receive concrete.

3. Where bottom of footing occurs in fill material, the fill and compaction operations shall continue until a minimum grade of 12” above bottom of footing is obtained. Footings may then be placed by excavating in accordance with methods herein specified.

4. Foundations shall be constructed as soon as possible after the foundation excavation to minimize damage to the bearing surface. If the bearing surface is softened by surface water intrusion or exposure, the softened soils must be removed immediately prior to placement of concrete. The bearing surface may be protected from extended exposure or imminent rainfall by placing a 2” mat of lean concrete on the bearing surface. Increase the foundation depth accordingly.

E. Cold Weather Protection: Protect excavation bottoms against freezing when the atmospheric temperature is less than 35 degrees F.

3.3 COMPACTION REQUIREMENTS

A. General: Compact and fill and backfill to the same density as adjacent in-place material.

B. Compaction Under Slabs and Structures:

1. All building areas shall be compacted and densified using a vibratory drum roller as specified herein. Vibratory compaction shall extend at least 5 feet beyond perimeter of building footings and foundations, slabs and walks. A minimum of sixteen complete coverages, eight in each direction, shall be made with the roller. Any soft yielding areas shall be excavated and replaced with acceptable fill material. Fill shall be placed in lifts not exceeding 12 inches in loose thickness. Continue compaction until requirements specified herein are attained.

C. Percentage of Maximum Density Requirements: Compact soils to not less than the following percentages of the Modified Proctor maximum dry density, ASTM D 1557.

1. Existing Subgrades Under Structures: Compact subgrade 24 inches below existing grade to 95 percent maximum density at optimum moisture. Increase compaction to 98 percent maximum density beneath the foundations and floors of the tanks.

2. Fill and Backfill Under Footings and Foundations: Compact each layer of fill or backfill to 95 percent maximum density at optimum moisture.

3. Walks and Slabs: Compact top 24 inches of subgrade and each layer of fill or backfill to 95 percent maximum density at optimum moisture.

D. Moisture Control:

1. Where the subgrade or layer of soil material must be moisture conditioned before compaction, uniformly apply water to the surface or subgrade, or layer of soil material, to prevent free water appearing on the surface during subsequent to compaction operations.

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

E. Backfilling Under Slabs and Structures:

1. Continue backfilling and compaction over entire building area to final elevation. Backfilling shall be in equal layers compatible with equipment used.

3.4 FIELD TESTING

A. Number of tests:

1. Make one optimum moisture-maximum density curve test in accordance with ASTM D 1557 for each class of material.

2. Make in-place density tests in accordance with ASTM D 1556, ASTM D 2937, or ASTM D 4253, as applicable, as fill and backfill work progresses. Test locations shall be as follows:

a) approximately every 100 cubic yards of fill and backfill; or 1,000 sq. ft. of building area, shall be tested.

b) at 75 linear feet of continuous wall footings.

B. Work on Tested Area: Placing permanent construction over fill that has not been tested and approved may require the Contractor to remove permanent work, recompact the fill and replace the work.

C. Test Reports:

1. Two copies of test reports shall be transmitted directly from the laboratory to the Architect-Engineer as directed.

2. Test reports shall be identified by the project title, A.E. File number, project location, and location and depth of each on-site test submitted.

END OF SECTION

SECTION 02665

SUPPORTS, ANCHORS AND THRUST CONTROL

PART 1 – GENERAL

1.01 DESCRIPTION OF WORK

A. The extent of work covered under this specification shall include, but not be limited to furnishing of all labor and materials required to adequately hang, support, anchor, tie back, isolate, restrain and provide thrust control for new piping work required under this contract.

1.02 QUALITY ASSURANCE:

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

1. All manufacturing of equipment and accessories covered in this specification as well as the installation of such shall be done in accordance with the applicable standard set forth in ASTM.

1.03 SUBMITTALS:

A.Submit manufacturer's certificate of material conformance to specification.

B. Submit manufacturer's literature, catalog data and installation instructions.

C. Submit shop drawing indicating dimensions, construction details, materials, finish, deflection for spring hanger and maximum load.

D. Submit design calculations and methods for thrust control devices.

PART 2 – PRODUCTS

2.01 GENERAL:

A. Furnish standard and fabricated supports and anchors complete with necessary inserts, bolts, nuts, rods, washers and other accessories.

B. Prevent contact between dissimilar metals by use of rubber or vinyl coatings.

2.02 ANCHORS AND SUPPORTS:

A. Expansion Bolts: Federal Specification FF-S-325.

1. In Concrete: Use Group II, Type 4, Class 1 or Group VIII, Type 1.

2. In Masonry: Use Group II, Type 3, Class 3.

3. Material: 18-8 stainless steel, including clips, washers and nuts.

4. Size and Length: As required or indicated.

5. Drilling: Conformance with manufacturer's instructions.

6.Acceptable: ITT Phillips Drill Division or equal.

B. Pipe Hangers and Supports: Provide where indicated on the drawings or where required.

1.Material: Stainless steel unless indicated otherwise.

2.Size and Length: As required or indicated.

2.03 RESTRAINED JOINTS:

A. Per JEA Standards

PART 3 – EXECUTION

3.01 JOB CONDITIONS:

A. Locate hanger, supports and anchors where indicated and as required to support pipelines, valves and additional concentrated loads.

1. Install items to be embedded before concrete is placed.

2. Fasten embedded items securely to prevent movement when concrete is placed.

3. Adjust as required using grout for concrete supports.

B. Pipe Thrust Restraints: Refer to JEA Standards. Mechanical restrainers shall be installed as required to properly restrain all piping systems. At a minimum, restrainers shall be provided on all below-grade valves and fittings and at the required number of pipe joints in each direction. Required lengths of restrained pipe shall be as shown in pipe restraint schedule below for the type of pipe and type of soil encountered. For above-grade piping, all valves and fittings shall be threaded, flanged or solvent welded with supports as required.

END OF SECTION

SECTION 02831

FENCING AND GATES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

A. Drawings and general provisions of Contract, including General and Supplementary Conditions apply to work of this section.

B. JEA “Water & Wastewater Standards Manual”, January, 2020 edition.

C. JEA Security Department fencing and gate standards.

1.02 DESCRIPTION OF WORK:

A. Extent of fence and gates are indicated on drawings.

1.03 QUALITY ASSURANCE:

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

1.04 DETAILED REQUIREMENTS

A. See the following attached sheets.

B. Minimum fabric height shall be 8’.

C. T-Line style gates are not allowed.

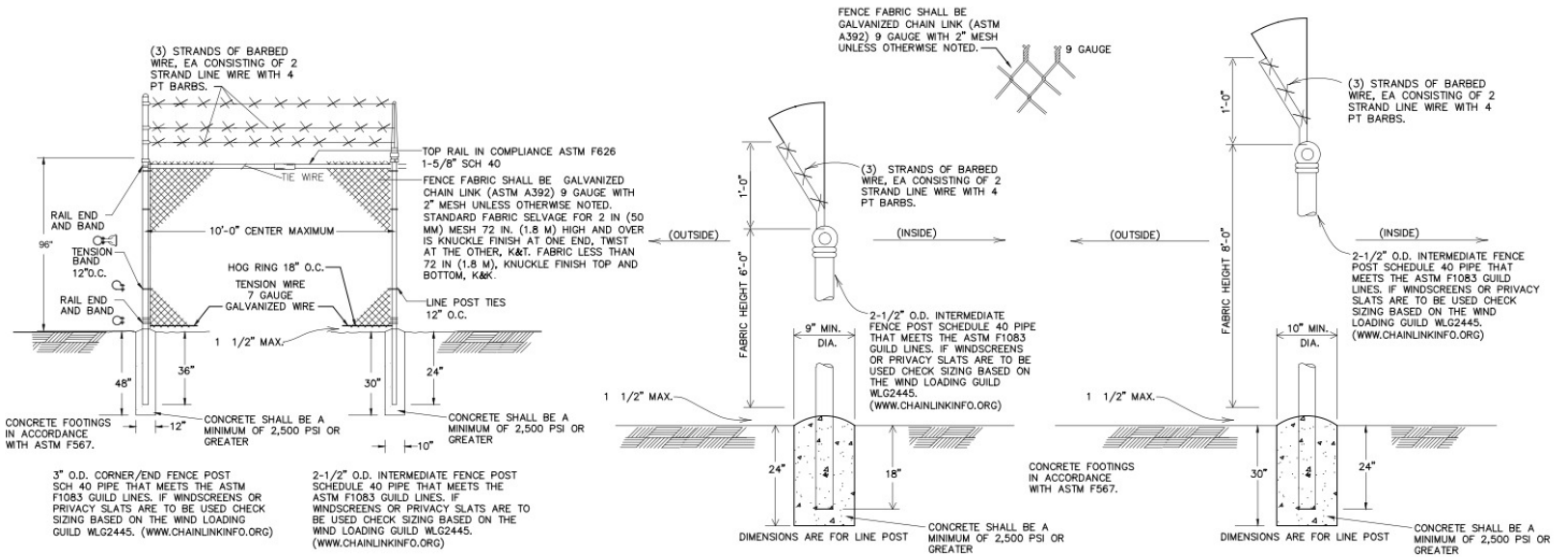
PART 2 – PRODUCTS

A. All components shall be per the attached JEA Security Department standards.

PART 3 – EXECUTION

A. All components shall be installed per JEA Security Department standards.

END OF SECTION



GENERAL
1. UNLESS OTHERWISE NOTED, ALL MATERIALS AND INSTALLATION PROCESSES SHALL CONFORM TO THE CHAINLINK MANUFACTURE INSTITUTE PRODUCT MANUAL (CLFMI-PM-2445)

1 FENCE – STANDARD
NOT TO SCALE

NO.	DATE	REVISIONS

VERIFY SCALES
BAR IS ONE INCH ON ORIGINAL DRAWING
0 1"
IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY.

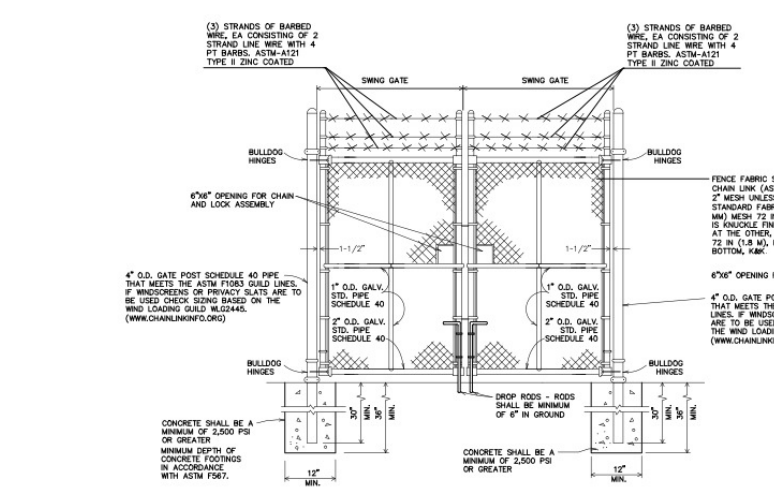
H. Stephen Jones and Associates, Inc.
"Providing Integrated Security Solutions"
12412 San Jose Blvd., Ste. 303
Jacksonville Fl. 32223
P:904.260.0024

JEA Building Community

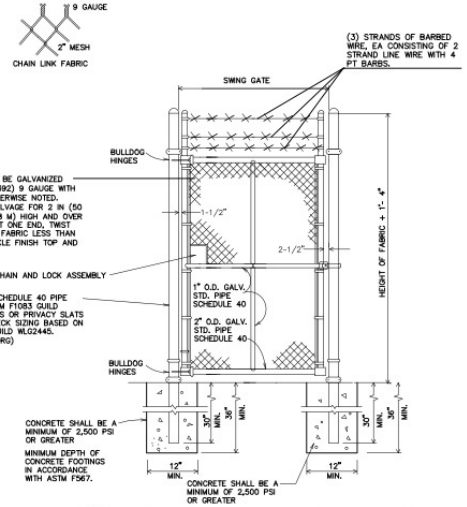
HSJ PROJECT NO.: 430-1401
DATE: 05/01/16
SCALE:

SECURITY TYPICAL
FENCE - STANDARD

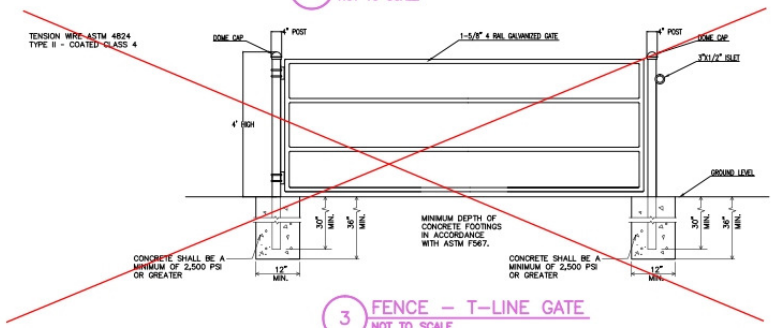
SHEET NO.: ST-6A



1 FENCE – DOUBLE SWING GATE
NOT TO SCALE



2 FENCE – SINGLE SWING GATE
NOT TO SCALE



3 FENCE – T-LINE GATE
NOT TO SCALE

GENERAL
1. UNLESS OTHERWISE NOTED, ALL MATERIALS AND INSTALLATION PROCESSES SHALL CONFORM TO THE CHAINLINK MANUFACTURE INSTITUTE PRODUCT MANUAL (CLFMI-PM-2445)

NO.	DATE	REVISIONS

VERIFY SCALES
BAR IS ONE INCH ON ORIGINAL DRAWING
0 1"
IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY.

H. Stephen Jones and Associates, Inc.
"Providing Integrated Security Solutions"
12412 San Jose Blvd., Ste. 303
Jacksonville Fl. 32223
P:904.260.0024

JEA Building Community

HSJ PROJECT NO.: 430-1401
DATE: 11/01/14
SCALE:

SECURITY TYPICAL FENCE - GATES

SHEET NO.: ST-6M

SECTION 02936

GRASSING

PART 1- GENERAL

1.1 SCOPE OF WORK

The specification for this project is JEA Specification - Grassing – Section 441. This specification is a clarification of type grassing to utilize on the project. Follow designation on plans – otherwise use sod around the electrical building, all precast structures located in grass area. Areas disturbed on the site not listed above shall be accomplished by hydroseeding.

PART 2 – PRODUCTS (JEA STANDARDS)

PART 3 – EXECUTION (JEA STANDARDS)

END OF SECTION

DIVISION 3

CONCRETE WORK

SECTION 03310

CONCRETE WORK

PART 1 – GENERAL

1.1 DESCRIPTION

A. The specification for this project is JEA Specification - Concrete Work – Section 437 and should be followed. This specification provides clarification and items not addressed in the JEA Standard.

B. Provide all concrete work shown and specified including form work, reinforcing steel, placing and curing.

C. All concrete for the project shall conform to requirements of ACI 301, except as noted herein.

1.2 CODES AND STANDARDS

A. Concrete work shall conform to the following by American Concrete Institute (ACI) unless modified herein or on the drawings.
   1. ACI 301: Specifications for Structural Concrete for Buildings.
   2. ACI 302: Guide for Concrete Floor and Slab Construction.
   3. ACI 304: Guide for Measuring, Mixing, Transporting, and Placing Concrete.
   4. ACI 308: Standard Practice for Curing Concrete.
   5. ACI 309: Guide for Consolidation of Concrete.
   6. SP-66: ACI Detailing Manual
   7. ACI 318: Buildings Code Requirements for Structural Concrete.
   8. ACI 347: Guide to Formwork for Concrete
   9. ACI 117: Standard tolerances for Concrete Construction and Materials.

1.3 QUALITY CONTROL

A. Concrete Testing Service: The Contractor shall employ and pay an independent testing laboratory to perform concrete testing. Laboratory shall meet the requirements of ASTM C 1077 "Standard Practice for Laboratories Testing Concrete and Concrete Aggregates for use in Construction and criteria for Laboratory Evaluation."

1.4 SUBMITTALS

A. Shop Drawings: Submit for fabrication and placement of concrete reinforcement. Comply with SP-66 showing bar schedules and arrangement of reinforcement.

B. Mix Design Tests Reports: Submit testing facility reports for each proposed mix at least 10 days prior to start or work.

C. Concrete Tests Reports: Submit laboratory test report for each concrete test specified herein. Test results shall be reported in writing to the Architect-Engineer and Contractor on the same day that the tests are made. Reports of compressive strength tests shall contain the project title and A.E. File number, date of concrete placement, name of Contractor, name of concrete supplier and truck number, name of concrete testing service, location of concrete batch in the structure, design compressive strength and type of break for both 7-day tests and 28-day tests.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Ready Mixed Concrete: Conform to ASTM C 94.

B. All concrete shall have a 28 day compressive strength as shown on the drawings .All concrete mixes shall be proportioned by the field experience method or the laboratory trial method in accordance with ACI 318.
   1. The maximum water/cement ratio shall be 0.45.
   2. All concrete, unless otherwise indicated, shall be air-entrained with an air content of 5% with a tolerance of ±1-1/2% unless noted otherwise on plans.

C. Slump: Grout for filling masonry cells and cavities shall have a slump of 9-1/2 inches ±1-1/2 inch. Concrete shall have a slump of 4-1/2 inches ±1-1/2 inch, except slab on grades shall have a maximum slump of 5 inches.

D. Concrete Materials:
   1. Portland Cement: ASTM C 150, Type 1/11.
   2. Water: Clean and potable.
   3. Air-Entraining Admixture: ASTM C 260.
   4. Water Reducing Admixture: ASTM C 494, Type A.
   5. Chloride Ions: Do not use calcium chloride in concrete unless otherwise authorized in writing by the Engineer. Do not use admixtures containing chloride ions in excess of amount found in municipal potable water.

E. Aggregates

   1. Regular Weight Concrete ASTM C33
   2. Lightweight Concrete: ASTM C 330.
   3. Grout: ASTM C 404

F. Concrete Reinforcing:
   1. Deformed Reinforcing Bars: ASTM A 615, Grade 60.
   2. Welded Wire Fabric: ASTM A 185

G. Anchor Bolts: Conform to ASTM A307 unless otherwise indicated on drawings. Nuts shall conform to ASTM A563, hex nuts. Bolts and nuts shall be hot dip galvanized after fabrication in accordance with ASTM A153.

H. Membrane-Forming Curing Compound: ASTM C 309, Type 1.

I. Water Curing - Moisture Retaining Cover: Provide waterproof Kraft paper, 4 mil polyethylene sheet or burlap.

J. Preformed Joint Material: ASTM D 1752 Type I, II or III or ASTM D 1751. Provide Sealtight by W. R. Meadows or approved equal.

2.2 NON-SHRINK GROUT

A. Non-metallic, cement base, showing no shrinkage under ASTM C 827 or under Corps of Engineer Specification CRD-C-621. Grout shall not contain expansive cements or metallic powders such as aluminum or iron filings. Grout shall have a minimum 28-day compressive strength of 4000 psi.

2.3 FORM MATERIALS

A. Forms for Exposed Finish Concrete:

1. Unless otherwise shown or specified, construct formwork for exposed concrete surfaces with plywood, metal, metal-framed plywood faced or other acceptable panel-type materials, to provide continuous, straight smooth, exposed surfaces. Furnish in largest practicable sizes to minimize number of joints and to conform to joint system shown on drawings. Provide form material with sufficient thickness to withstand pressure of newly-placed concrete without bow or deflection.

2. Use overlaid plywood complying with U.S. Product Standard PS-1 "B-B High Density Overlaid Concrete Form", Class I.

B. Forms for unexposed Finish Concrete: Form concrete surfaces which will be unexposed in finished structure with plywood, lumber, metal or other acceptable material. Provide lumber dressed on at least two edges and one side for tight fit.

C. Form Coatings: Provide commercial formulation form-coating compounds that will not bond with, stain nor adversely affect concrete surfaces, and will not impair subsequent treatments of concrete surfaces to be cured with water or curing compound.

PART 3 – EXECUTION

3.1 INSTALLATION

A. Formwork: Construct so that concrete members and structures are of correct size, shape, alignment, elevation and position. Chamfer exposed edges and corners of formed concrete 3/4 inch unless otherwise indicated. Conform to ACI 347. Design of formwork is the responsibility of the Contractor.

B. Reinforcement: Locate and support with metal chairs, runners, bolsters spacers and hangers, in compliance with SP66, ACI Detailing Manual For

support of reinforcing steel in slabs or beams exposed to view underneath, furnish plastic accessories or accessories having plastic-coated feet.

C. Joints: Provide construction, isolation and control joints as indicated or required. Locate construction joints so as to not impair the strength and appearance of the structure.

D. Concrete Placement: Conform to ACI 304. Place concrete in a continuous operation with planned joints or sections. Do not begin placement until work of other trades affecting concrete is completed.

E. Consolidate placed concrete using mechanical vibrating equipment with hand rodding and tamping, so that concrete is worked around reinforcement and other embedded items and into all parts of forms. Conform to ACI 309.

F. Cold Weather Placing:
   1. Protect concrete work from physical damage or reduced strength which could be caused by frost, freezing actions, or low temperatures, in compliance with ACI 306 and as herein specified. When air temperature has fallen to or is expected to fall below 40 degrees F., uniformly heat all water and aggregates before mixing as required to obtain a concrete mixture temperature of not less than 50 degrees F., and not more than 80 degrees F. at point of placement.
   2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
   3. Do not use calcium chloride, salt and other materials containing antifreeze agents or chemical accelerators, unless otherwise accepted in mix designs.

G. Hot Weather Placing: When hot weather conditions exist that would seriously impair the quality and strength of concrete, place concrete in compliance with ACI 305 and as herein specified.

   1. Wet forms thoroughly before placing concrete.
   2. Do not use retarding admixtures unless otherwise accepted in mix designs.

H. Shoring shall remain in place until concrete has obtained 2/3 of the design strength, as determined by laboratory tests.

3.2 FINISH FORMED SURFACES

A. All Surfaces: Immediately after form removal, remove fins, surface blemishes and other surface irregularities. Cut out defective surfaces including voids, honeycomb and rockpockets. Fill all voids and form tie holes with 1:3 cement- fine aggregate grout and rub smooth; match color and texture of adjacent surfaces.

B. Exposed to View Surfaces: Within 24 hours after form removal, wet surface and rub with carborundum brick until a smooth uniform finish is obtained. Provide rubbed finish for / all exposed concrete / all concrete indicated.

3.3 SLAB FINISH

A. Screed concrete to a uniform level surface, rod and spade to fill solid at form edges, corners and at penetrations. Tamp surface to drive course aggregate below top surface. Screed again to a level, smooth surface.

B. Rough Slab Finish: After final screed, roughen with stiff wire brush or rake. Provide for surfaces that receive mortar set ceramic tile, cement topping and concrete fill. Tolerance:1/2 inch in 10 feet when tested with a 10 foot straight edge.

C. Start finishing procedures after bleedwater has disappeared from the surface

D. Float Finish: Power float to a true plane within 5/16 inch in 10 feet when tested with a straight edge. Refloat immediately to a uniform and float texture. Hand float areas inaccessible to power float. Provide for equipment slabs and non- traffic exterior slabs.

E. Troweled Finish: Power trowel to a true plane within 1/4 inch in 10 feet when tested with a 10 foot straightedge. Follow with additional passes with the hand trowel until a ringing sound is produced when the trowel is moved over the surface.

F. Non-Slip Broom Finish: After final screed and while slabs are wet steel trowel to true plane with 1/4 inch in 10 feet when tested with a 10 foot straightedge. While surface is still wet and workable, finish with soft bristle broom. Draw broom across surface perpendicular to traffic pattern. Provide for all exterior slabs, stairs, platforms and ramps subject to traffic and elsewhere as shown on the drawings.

3.4 CURING

A. Conform to ACI 308. Begin initial curing as soon as free water has disappeared from exposed surfaces. Keep all concrete continuously moist for not less than 72 hours. Continue curing by use of moisture-retaining cover or membrane- forming curing compound. Cure formed surfaces by moist curing until forms are removed. Provide protection as required to prevent damage to exposed concrete surfaces. Water curing may be used for all surfaces but must be used for surfaces to be painted and surfaces to which cementitious materials are to be bonded. Water cure 7 days.

3.5 CONCRETE TESTING

A. Compressive strength Tests: Conform to ASTM C31 and ASTM C39. One set of four cylinders for each 1 5 0 c.u. yds. or fraction thereof, of each strength concrete placed in any one day. Test one specimen at seven days; test two specimens at 28 days and hold one in reserve.

B. Slump Tests: Conform to ASTM C143. Perform one test for each load point

of discharge and one for each set of compressive strength test specimens.

END OF SECTION

DIVISION 4

MASONRY

NOT USED

DIVISION 5

METALS

SECTION 05500

METAL FABRICATION

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor, materials, equipment and incidentals required and install all miscellaneous metal complete as shown on the Drawings and as specified herein.

1.02 SUBMITTALS

A. Submit to the Engineer, in accordance with Section 01300, shop drawings and product data showing materials of construction and details of installation for:

1. Shop drawings, Showing sizes of members, method of assembly, anchorage and connection to other members.

B. Samples

1. Submit samples as requested by the Engineer during the course of construction.

C. Design Data

1. Submit calculations or test data demonstrating that the railings will resist the loads specified in the 2001 Florida Building Code at the post spacing provided.

2. Submit manufacturer's load and deflection tables for grating.

D. Test Reports

1. Certified copy of mill test reports on each aluminum proposed for use showing the physical properties and chemical analysis.

E. Certificates

1. Submit certification that the railing system is in compliance with OSHA requirements and the Florida Building Code, latest.

2. Certify that welders have been qualified under AWS, within the previous 12 months, to perform the welds required under this Section.

1.04 REFERENCE STANDARDS

A. Aluminum Association (AA)

1. AA M31C22A41

a. M31: Mechanical Finish, Fine Satin

b. C22: Finish, Medium Matte

c. A41: Clear Anodic Coating, Class 1

B. American Society for Testing and Materials (ASTM)

1. ASTM A36 - Standard Specification for Carbon Structural Steel.

2. ASTM A48 - Standard Specification for Gray Iron Castings.

3. ASTM A53 - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.

4. ASTM A108 - Standard Specification for Steel Bars, Carbon, Cold Finished, Standard Quality.

5. ASTM A123 - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

6. ASTM A153 - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

7. ASTM A167 - Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet and Strip.

8. ASTM A276 - Standard Specification for Stainless Steel Bars and Shapes.

9. ASTM A307 - Standard Specification for Carbon Steel Bolts and Studs, 60,000 Psi Tensile Strength.

10. ASTM A325 - Standard Specification for Structural Bolts, Steel, Heat Treated, I20110S ksi Minimum Tensile Strength.

11. ASTM A366 - Standard Specification for Steel, Sheet, Carbon, Cold-Rolled, Commercial Quality.

12. ASTM A500 - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.

13. ASTM A501 - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing.

14. ASTM A536 - Standard Specification for Ductile Iron Castings.

15. ASTM A570 - Standard Specification for Steel, Sheet and Strip, Carbon, Hot-Rolled, Structural Quality.

16. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.

17. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles and Tubes.

18. ASTM B429 - Standard Specification for Aluminum-Alloy Extruded Structural Pipe and Tube.

C. American Iron and Steel Institute (AISI).

1. Specification for Structural Steel Buildings.

D. American Welding Society (AWS)

1. AWS D 1.1 - Structural Welding Code Steel.

2. AWS D 1.2 - Structural Welding Code Aluminum.

E. Federal Specifications

1. FS-FF-B-575C - Bolts, Hexagonal and Square

F. Occupational Safety and Health Administration (OSHA)

G. Florida Building Code (FBC), latest edition

H. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

1.05 QUALITY ASSURANCE

A. The work of this Section shall be completely coordinated with the work of other Sections. Verify, at the site, both the dimensions and work of other trades adjoining items of work in this Section before fabrication and installation of items herein specified.

B. Furnish to the pertinent trades all items included under this Section that are to be built into the work of other Sections.

C. All welding shall be performed by qualified welders and shall conform to the applicable A WS welding code. Welding of steel shall conform to AWS D 1.1 and welding of aluminum shall conform to AWS D 1.2.

1.06 DELIVERY, STORAGE AND HANDLING

A. Deliver items to be incorporated into the work of other trades in sufficient time to be checked prior to installation.

B. Repair items which have become damage or corroded to the satisfaction of the Engineer prior to incorporating them into the work.

1.07 PROJECT/SITE REQUIREMENTS

A. Field measurements shall be taken at the site, prior to fabrication of items, to verify or supplement indicated dimensions and to ensure proper fitting of all items.

PART 2 PRODUCTS

2.01 GENERAL

A. The use of manufacturer's name and model or catalog number is for the purpose of establishing the standard of quality and general configuration desired.

B. Like items of materials shall be the end products of one manufacturer in order to provide standardization for appearance, maintenance and manufacturer's service.

2.02 MATERIALS

A. Unless otherwise noted, materials for miscellaneous metals shall conform to the following standards:

1.	Structural Steel	ASTMA36
2.	Structural Steel Tubing	ASTM A500, Grade B
3.	Welded and Seamless Steel Pipe	ASTM A501 or ASTM A53, Type E or S, Grade B Schedule 40. Use standard malleable iron fittings, galvanized for exterior work
4.	Steel Sheets	ASTMA366
5.	Gray Iron Castings	ASTM A48, Class 35
6.	Ductile Iron Castings	ASTM A536, Grade 65-45-12
7.	Aluminum Extruded Pipe	ASTM B429, Alloy 6063 T6
8.	Aluminum Extruded Shapes	ASTM B22I, Alloy 6061 T6
9.	Aluminum Sheet and Plate	ASTM B209, Alloy 6061 T6
10.	Stainless Steel Plates, Sheets, and Structural Shapes	
	a. Exterior, Submerged or Industrial Use	ASTM A167, Type 316 (Type 316L for welded)
	b. Interior and Architectural Use	ASTM A167, Type 304
11.	Stainless Steel Bolts, Nuts, and Washers	ASTM A276, Type 316
12.	Carbon Steel Bolts and Studs	ASTM A307, Grade A (hot dip galvanized nuts and washers where noted)
13.	High Strength Steel Bolts, Nuts and Washers	ASTM A325 (mechanically galvanized per ASTM B695, Class 50, where noted)
	a. Elevated Temperature Exposure	Type I

	b. General Application	Type I or Type II
14.	Galvanizing	ASTM A123, Zn w/0.5 percent minimum Ni
15.	Galvanizing, hardware	ASTM A153, Zn w/O.5 percent minimum Ni

2.03 ANCHORS, BOLTS AND FASTENING DEVICES

A. Anchor bolt material shall be ASTM A307 unless otherwise noted.

B. Unless otherwise noted, bolts for the connection of carbon steel or iron shall be steel machine bolts; bolts for the connection of galvanized steel or iron shall be galvanized steel or stainless steel machine bolts; and bolts for the connection of aluminum or stainless steel shall be stainless steel machine bolts.

C. Unless otherwise noted, expansion anchors shall be zinc plated carbon steel wedge type anchors complete with nuts and washers. Type 316 stainless steel, wedge type anchors shall be used where they will be submerged or exposed to the weather or where stainless steel wedge type anchors are required. When the length or embedment of the bolt is not noted on the Drawings, provide length sufficient to place the wedge and expansion sleeve portion of the bolt at least 1-in behind the concrete reinforcing steel. Expansion anchors shall be Hilti, Kwick-bolt II; ITW Ramset; Redhead trubolt, or equal.

D. Compound masonry expansion anchors shall be lead expansion sleeve type anchors complete with nuts and washers. Anchors shall be precision die-cast zinc alloy with a minimum of two lead alloy expansion sleeves. When the length or embedment of the bolt is not noted on the Drawings, provide length sufficient to place the wedge and expansion sleeve portion of the bolt at least 1-in behind the concrete reinforcing steel. Expansion anchors shall be Star Expansion Industries, Star Slugin or equal.

E. Adhesive capsule anchors shall be a two-part stud and capsule chemical resin anchoring system. Capsules shall contain premeasured amounts of polyester or vinyl ester resin, aggregate and a hardener contained in a separate vial within the capsule. Stud assemblies shall consist of an all-thread anchor rod with nut and washer. Adhesive capsule anchors shall be Hilti, HVA Adhesive Anchor; Molly, Parabond; Rawlplug, Rawl Chem-Stud or equal.

F. Adhesive anchors, for fastening to hollow concrete block or brick, shall be a three-part stud, screen and chemical dispenser anchoring system. Adhesive cartridges shall contain premeasured amounts of resin and hardener which are mixed and deposited in a screen tube by a dispenser. Stud assemblies shall consist of an all-thread anchor rod with nut and washer. Anchors shall be Hilti, HIT C-20 System or equal.

G. Automatic end welded headed anchor studs shall be flux ended studs made from cold drawn steel, ASTM A108 Grades C-1010 through C-1020. Headed anchor studs shall be Nelson, H4L Headed Concrete Anchors or equal.

H. Machine bolts and nuts shall conform to Federal Specification FF-B-575C. Bolts and nuts shall be hexagon type. Bolts, nuts, screws, washers and related appurtenances shall be Type 316 stainless steel.

I. Toggle bolts shall be Hilti, Toggler Bolt or equal.

2.04 METAL GRATING

A. Grating shall have rectangular, 3/16-in thick, bearing bars spaced 1-3/16-in on center with cross bars spaced at 4-in on center. All grating panels shall be banded with a bar the same size as the bearing bars.

1. Grating shall not exceed the fabricator's maximum recommended span, and meet or exceed the following load and deflection criteria for the maximum span length at the opening being covered by the grating.

a. The grating shall produce a deflection of 1/360 of the span or less under a uniform live load of 100 lbs/sq ft on the maximum span.

b. The grating shall produce a deflection of 1/360 of the span or less under a concentrated live load of 300 lbs applied at the mid point of the maximum span.

2. Openings 2-in or greater in diameter/dimension and grating edges shall be banded with a bar of the same depth and thickness as the bearing bars. Cut bearing bars or cross bars shall be welded to the banding bar.

3. Provide trench grating with symmetrical cross bar arrangement.

4. Grating clamps, nuts, bolts, washers and other fastening devices for grating and grating supports shall be Type 316 stainless steel. All grating shall be anchored to the supporting system using saddle clips.

B. Aluminum grating material shall be aluminum alloy 6063-T6 with an anodized finish. Cross bars shall be attached to the bearing bars with interlocked swaged joints. The grating shall be Type BS by IKG Borden, Houston, TX; Type 19 SG-4 by Ohio Gratings, Inc., Canton, OH; Type 19S4 by Seidelhuber Metal Products, San Carlos, CA or equal.

C. Metal frames and supports for grating shall be of the same material as the grating unless otherwise shown on the Drawings. Where aluminum supports are used, they shall be fabricated from aluminum alloy 6061-T6.

2.05 RAILINGS

A. Handrail and railing systems shall comply with the requirements of OSHA and FBC.

B. Aluminum railing and handrail shall be a welded or mechanically fastened, seamless, extruded aluminum pipe system. Rails shall be 6063-T6 alloy. Posts shall be 6061-T6 alloy. Splice and reinforcing sleeves, brackets, end caps, toeboards, etc, shall be aluminum alloy 6063-T6 or 6061-T6. Cast fittings shall be aluminum alloy No. 214. Railing system fastening hardware shall be Type 304 stainless steel. Aluminum shall have a mill finish. After welding, aluminum shall be anodized. All railing, posts, toeboards and exposed aluminum shall be anodized with an architectural Class I satin finish providing a

minimum coating thickness of 0.7 mils and a minimum coating weight of 32-milligrams per square inch in compliance with AA M12C22A41.

C. Railings shall be 2 rail welded or mechanically fastened railing systems, as shown on the Drawings, fabricated with 1-1/2-in nominal diameter pipe. Posts shall be Schedule 80 pipe, minimum, and rails and handrail shall be Schedule 40 pipe, minimum. Posts and top rails shall be continuous. Spacing of posts shall not exceed 5-ft on center and shall be uniformly spaced except as otherwise shown on the Drawings. Posts will be required on each side of structure expansion joints. All railing posts shall be vertical.

D. Welds shall be circumferential welds ground smooth and even to produce a railing that is neat in appearance and structurally sound. Welding methods shall be in conformity with AWS standards for the materials being joined. All rail to post connections shall be coped and fastened by continuous welds. There shall be no burrs, sharp edges or protrusions on any weld on any part of the handrail system. After fabrication, the welds and surrounding area shall be cleaned and hand buffed to blend with the adjacent finish. All mechanical fasteners shall be unobtrusively located in countersunk holes with the top flush with the surface of the rail. Bends in the railing shall be as indicated by the Drawings. No distortion of the circular railing shape will be allowed. Bends and terminal sections shall be made without the use of fittings. Corner bends shall be mitered and welded bends.

E. Railing shall be assembled}led in sections as long as practical but shall not be greater than 24-ft in length. A field splice shall be used when an assembled section is to be attached to another section. Field splices shall be used in all railing panels that cross over structure expansion joints.

1. Field splices shall use internal splice sleeves located within 8-in of railing posts. The sleeve shall be welded to the rail on one side and fastened with a set screw to the rail on other side. The field splice shall be detailed to take the differential expansion between the railing system and the supporting structure.

2. When the field splice occurs in a railing panel crossing a structure expansion joint, the sleeve shall be welded to the rail on one side and be free to slide in the rail on other side. The field splice shall be detailed to take the same movement as the structure expansion joint.

F. The bases or supports for railing posts and handrail shall be the types indicated on the Drawings.

1. Where non-removable railing is set in concrete, the posts shall be placed in 2-1/2-in diameter formed concrete openings and firmly caulked with a non sulphur compound, hydraulic cement equal to Por-Rok by Minwax Construction Products Division, Sterling Drug, Montvale, NJ. Collars shall be placed around the post bases and fastened in place with set screws on the side of the post away from the walkway. Posts shall be placed with the centerline 4-in from the edge of the concrete except that posts shall be set at the centerline of concrete curbs.

2. Stainless steel and aluminum railing posts, which may collect condensation, shall have a 3/16-in drain hole drilled immediately above the concrete encased area, the base flange, or supporting socket on the side away from the walking area. The bottom of the rail post between the drain hole and the bottom of the post shall be filled with an inert material such as a compressed closed cell neoprene rod.

3. Where handrail is to be fastened to walls, the rails shall be provided with screwed wall flanges fastened to the walls with three 3/8-in stainless steel flat head machine screws.

G. Safety gates, for railing openings, shall be fabricated of matching pipe and rail material and configuration. The gates shall be self-closing gates with approved stop, latch and stainless steel closure spring and hinges.

H. Barrier chains, for railing openings, shall be fabricated of stainless steel chains. Chain shall be 1/4-in stainless steel links, with eleven links per foot as manufactured by Eastern Chain Works, Inc., NY; Lawrence Metal Products, Inc. or equal. Chains shall be fastened to the handrail posts at the elevation of each rail. One end of each chain shall be connected to one post with a 1/4-in diameter stainless steel eye bolt and the other end shall be connected to the other post by means of a heavy chromium plated bronze swivel eye slide harness snap and a similar eye bolt.

I. Toeboards shall be provided on all railing adjacent to a drop in elevation of 4-ft or more. Toeboards are not required on the inclined portion of stairway railings or where concrete or steel curbs, 4-in or more in height, are present. Toeboards shall be 4-in high channels of the same material as the railing. The channels shall have a minimum thickness of 1l8-in and have flanges of not less than 3/4-in nor more than 1-1/2-in in width. Toeboards shall be positioned with a maximum clearance of 1/4-in from the floor and fastened to railing posts with 1/4-in stainless steel U-bolts, with J-bolts at corner posts and with clip angles and two 1/4-in stainless steel expansion bolts at walls.

J. All railings shall be properly protected by paper, or by an approved coating or by both against scratching, splashes or mortar, paint, or other defacements during transportation and erection and until adjacent work by other trades has been completed. After protective materials are removed, the surfaces shall be made clean and free from stains, marks, or defects of any kind.

2.06 ACCESS HATCHES

A. Access hatches shall have single or double leaf doors as indicated by the Drawings. The doors shall be 1/4-in aluminum diamond pattern plate with welded stiffeners, as necessary, to withstand a live load of 300 lbs/sq ft with a maximum deflection of 1/150th of the span. Hatches shall have a 1/4-in aluminum channel frame with a perimeter anchor flange or strap anchors for concrete embedment around the perimeter. Unless otherwise noted on the Drawings, use pivot torsion bars for counterbalance or spring operators for easy operation along with automatic door hold open. Hardware shall be durable and corrosion resistant with Type 316 stainless steel hardware used throughout. Provide removable lock handle. Finish shall be the factory mill finish for aluminum doors and frames with bituminous coating on the exterior of the frames in contact with concrete. Hatches shall be watertight and have a 1-1/2-in drainage coupling to the channel frame. Access hatches shall be Types as indicated on the Drawings by Bilco Company, New Haven, CT or equal.

2.07 MISCELLANEOUS ALUMINUM

A. All miscellaneous metal work shall be formed true to detail, with clean, straight, sharply defined profiles and smooth surfaces of uniform color and texture and free from defects impairing strength or durability. Holes shall be drilled or punched. Edges shall be smooth and without burrs. Fabricate supplementary pieces necessary to complete each item though such pieces are not definitely shown or specified.

B. Connections and accessories shall be of sufficient strength to safely withstand the stresses and strains to which they will be subjected. Exposed joints shall be close fitting and jointed where least conspicuous. Threaded connections shall have the threads concealed where practical. Welded connections shall have continuous welds or intermittent welds as specified or shown. The face of welds shall be dressed flush and smooth. Welding shall be on the unexposed side as much as possible in order to prevent pitting or discoloration of the aluminum exposed surface. Grind smooth continuous welds that will be exposed. Provide holes for temporary field connections and for attachment of the work of other trades.

C. Miscellaneous aluminum items shall include: beams, angles, closure angles, grates, hatches, floor plates, stop plates, stair nosings, and any other miscellaneous aluminum called for on the Drawings and not otherwise specified.

D. Angle frames for hatches, beams, grates, etc, shall be complete with welded strap anchors attached.

E. Aluminum diamond plate and floor plate shall have a minimum thickness of 3/8-in. Frames and supports shall be of aluminum construction. Fastening devices and hardware shall be Type 304 stainless steel. Plates shall have a mill finish.

F. Stair treads for aluminum stairs shall have abrasive non-slip nosing as approved.

G. Aluminum nosing at concrete stairs shall be Wooster Products, Inc.; Alumogrit Treads, Type 116; similar by Barry Pattern and Foundry Co.; Andco or equal. Furnish with wing type anchors and flat head stainless steel machine screws, 12-in on center. Nosing shall also be used at concrete ladder openings. Nosing shall a single piece for each step extending to within 3-in at each side of stair or full ladder width. Set nosing flush with stair tread finish at concrete stairs. Furnish treads with heavy duty protective tape cover.

H. Miscellaneous aluminum items shall have a cleaned and degreased mill finish.

2.09 MISCELLANEOUS STEEL

A. All miscellaneous metal work shall be formed true to detail, with clean, straight, sharply defined profiles and smooth, surfaces of uniform color and texture and free from defects impairing strength or durability. Holes shall be drilled or punched. Edges shall be smooth and without burrs. Fabricate supplementary pieces necessary to complete each item though such pieces are not definitely shown or specified.

B. Connections and accessories shall be of sufficient strength to safely withstand the stresses and strains to which they will be subjected. Exposed joints shall be close fitting and jointed where least conspicuous. Threaded connections shall have the threads concealed where practical. Welded connections shall have continuous welds or intermittent welds as specified or shown. The face of welds shall be dressed flush and smooth. Grind smooth continuous welds that will be exposed. Provide holes for temporary field connections and for attachment of the work of other trades.

C. Miscellaneous steel items shall include: beams, angles, lintels, metal stairs, support brackets, base plates for other than structural steel or equipment, closure angles, bridge 'crane rails, monorail hoist beams, hold-down straps and lugs, door frames, splice plates, sub framing at roof openings and any other miscellaneous steel called for on the Drawings and not otherwise specified.

D. Structural steel angle and channel door frames shall be shop coated with primer. Frames shall be fabricated with not less than three anchors on each jamb. '

E. Steel pipe pieces for sleeves, lifting attachments and other functions shall be Schedule 40 pipe unless otherwise shown on the Drawings. Wall and floor sleeves, of steel pipe, shall have welded circumferential steel waterstops at mid-length.

F. Lintels, relief angles or other steel supporting masonry or embedded in masonry shall be shop coated with primer.

G. All steel finish work shall be thoroughly cleaned, by effective means, of all loose mill scale, rust and foreign matter and shall be given one shop coat of primer compatible with the finish coat after fabrication but before shipment. Paint shall be omitted within 3-in of proposed field welds. Paint shall be applied to dry surfaces and shall be thoroughly and evenly spread and well worked into joints and other open spaces.

H. Galvanizing, where required, shall be the hot-dip zinc process after fabrication. Coating shall be not less than 2-oz/sq ft of surface.

2.08 MISCELLANEOUS STAINLESS STEEL

A. All miscellaneous metal work shall be formed true to detail, with clean, straight, sharply defined profiles and smooth surfaces of uniform color and texture and free from defects impairing strength or durability. Holes shall be drilled or punched. Edges shall be smooth and without burrs. Fabricate supplementary pieces necessary to complete each item though such pieces are not definitely shown or specified.

B. Connections and accessories shall be of sufficient strength to safely withstand the stresses and strains to which they will be subjected. Exposed joints shall be close fitting and jointed where least conspicuous. Threaded connections shall have the threads concealed where practical. Welded connections shall have continuous welds or intermittent welds as specified or shown. The face of welds shall be dressed flush and smooth. Grind smooth continuous welds that will be exposed. Provide holes for temporary field connections and for attachment of the work of other trades.

C. Miscellaneous stainless steel items shall include: beams, angles, bar racks and any other miscellaneous stainless steel called for on the Drawings and not otherwise specified.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install all items except those to be embedded in concrete or other masonry which shall be installed under Division 3 and Division 4 respectively. Items to be attached to concrete or masonry after such work is completed shall be installed in accordance with the details shown. Fastening to wood plugs in masonry will not be permitted.

B. Abrasions in the shop primer shall be touched up immediately after erection. Areas left unprimed for welding shall be painted with primer after welding.

C. Zinc coating which has been burned by welding, abraded, or otherwise damaged shall be cleaned and repaired after installation. The damage area shall be thoroughly cleaned by wire brushing and all traces of welding flux and loose or cracked zinc coating removed

prior to painting. The cleaned area shall be painted with two coats of zinc oxide-zinc dust paint conforming to the requirements of Military Specifications MIL-P-15145. The paint shall be properly compounded with a suitable vehicle in the ratio of one part zinc oxide to four parts zinc dust by weight.

D. Specialty products shall be installed in accordance with the manufacturer's recommendations.

E. Expansion bolts shall be checked for tightness a minimum of 24 hours after initial installation.

F. Install adhesive capsule anchors using manufacturer's recommended drive units and adapters and in compliance with the manufacturer's recommendations.

G. Headed anchor studs shall be welded in accordance with manufacturer's recommendations.

H. All railings shall be erected to line and plumb.

I. All steel surfaces that come into contact with exposed concrete or masonry shall receive a protective coating of an approved heavy bitumastic troweling mastic applied in accordance with the manufacturer's instructions prior to installation.

J. Where aluminum contacts a dissimilar metal, apply a heavy brush coat of zinc-chromate primer followed by two coats of aluminum metal and masonry paint to the dissimilar metal.

K. Where aluminum contacts masonry or concrete, apply a heavy coat of approved alkali resistant paint to the masonry or concrete.

L. Where aluminum contacts wood, apply two coats of aluminum metal and masonry paint to the wood.

M. Between aluminum grating, aluminum stair treads, or aluminum handrail brackets and steel supports, insert 1/4-in thick neoprene isolator pads, 85 plus or minus 5 Shore A durometer, sized for full width and length of bracket or support.

END OF SECTION

SECTION 05505

STAIR NOSING

PART 1 - GENERAL

1.1 - SCOPE OF WORK

A. Furnish all labor, materials, equipment and incidentals required and install all miscellaneous metal complete as shown on the Drawings and as specified herein.

1.2 - SUBMITTALS

A. Submit to the Engineer, in accordance with Section 01300, shop drawings and product data showing materials of construction and details of installation for:

1. Shop drawings, Showing sizes of members, method of assembly, anchorage and connection to other members.

1.3 - REFERENCE STANDARDS

A. American Society for Testing and Materials (ASTM)
1. ASTM F609 - Standard Test Method for Using a Horizontal Pull Slipmeter

B. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

1.4 - QUALITY ASSURANCE

A. The work of this Section shall be completely coordinated with the work of other Sections. Verify, at the site, both the dimensions and work of other trades adjoining items of work in this Section before fabrication and installation of items herein specified.

B. Furnish to the pertinent trades all items included under this Section that are to be built into the work of other Sections.

1.5 - DELIVERY, STORAGE AND HANDLING

A. Deliver items to be incorporated into the work of other trades in sufficient time to be checked prior to installation.

B. Repair items which have become damaged or corroded to the satisfaction of the Engineer prior to incorporating them into the work.

1.6 - PROJECT/SITE REQUIREMENTS

A. Field measurements shall be taken at the site, prior to fabrication of items, to verify or supplement indicated dimensions and to ensure proper fitting of all items.

PART 2 - PRODUCTS

2.1 - GENERAL

A. The use of manufacturer's name and model or catalog number is for the purpose of establishing the standard of quality and general configuration desired.

B. Like items of materials shall be the end products of one manufacturer in order to provide standardization for appearance, maintenance and manufacturer's service.

2.2 - MATERIALS

A. Unless otherwise noted, materials for miscellaneous metals shall conform to the following standards:

1. Structural Steel ASTMA36

2.	Structural Steel Tubing	ASTM A500, Grade B
3.	Welded and Seamless Steel Pipe	ASTM A501 or ASTM A53, Type E or S, Grade B Schedule 40. Use standard malleable iron fittings, galvanized for exterior work
4.	Steel Sheets	ASTMA366
5.	Gray Iron Castings	ASTM A48, Class 35
6.	Ductile Iron Castings	ASTM A536, Grade 65-45-12
7.	Aluminum Extruded Pipe	ASTM B429, Alloy 6063 T6
8.	Aluminum Extruded Shapes	ASTM B22I, Alloy 6061 T6
9.	Aluminum Sheet and Plate	ASTM B209, Alloy 6063 T6
10.	Stainless Steel Plates, Sheets, and Structural Shapes	
	a. Exterior, Submerged or Industrial Use	ASTM A167, Type 316 (Type 316L for welded)
	b. Interior and Architectural Use	ASTM A167, Type 304
11.	Stainless Steel Bolts, Nuts, and Washers	ASTM A276, Type 316
12.	Carbon Steel Bolts and Studs	ASTM A307, Grade A (hot dip galvanized nuts and washers where noted)
13.	High Strength Steel Bolts, Nuts and Washers	ASTM A325 (mechanically galvanized per ASTM B695, Class 50, where noted)
	a. Elevated Temperature Exposure	Type I
	b. General Application	Type I or Type II
14.	Galvanizing	ASTM A123, Zn w/0.5 percent minimum Ni
15.	Galvanizing, hardware	ASTM A153, Zn w/O.5 percent minimum Ni

2.3 - ANCHORS, BOLTS AND FASTENING DEVICES

A. Anchor bolt material shall be ASTM A316 unless otherwise noted.

B. Unless otherwise noted, bolts for the connection of carbon steel or iron shall be steel machine bolts; bolts for the connection of galvanized steel or iron shall be galvanized steel or stainless steel machine bolts; and bolts for the connection of aluminum or stainless steel shall be stainless steel machine bolts.

C. Unless otherwise noted, expansion anchors shall be zinc plated carbon steel wedge type anchors complete with nuts and washers. Type 316 stainless steel, wedge type anchors shall be used where they will be submerged or exposed to the weather or where stainless steel wedge type anchors are required. When the length or embedment of the bolt is not noted on the Drawings, provide length sufficient to place the wedge and expansion sleeve portion of the bolt at least 1-in behind the concrete reinforcing steel. Expansion anchors shall be Hilti, Kwick-bolt II; ITW Ramset; Redhead trubolt, or equal.

D. Compound masonry expansion anchors shall be lead expansion sleeve type anchors complete with nuts and washers. Anchors shall be precision die-cast zinc alloy with a minimum of two lead alloy expansion sleeves. When the length or embedment of the bolt is not noted on the Drawings, provide length sufficient to place the wedge and expansion sleeve portion of the bolt at least 1-in behind the concrete reinforcing steel. Expansion anchors shall be Star Expansion Industries, Star Slugin or equal.

E. Adhesive capsule anchors shall be a two-part stud and capsule chemical resin anchoring system. Capsules shall contain premeasured amounts of polyester or vinyl ester resin, aggregate and a hardener contained in a separate vial within the capsule. Stud assemblies shall consist of an all-thread anchor rod with nut and washer. Adhesive capsule anchors shall be Hilti, HVA Adhesive Anchor; Molly, Parabond; Rawlplug, Rawl Chem-Stud or equal.

F. Adhesive anchors, for fastening to hollow concrete block or brick, shall be a three-part stud, screen and chemical dispenser anchoring system. Adhesive cartridges shall contain premeasured amounts of resin and hardener which are mixed and deposited in a screen tube by a dispenser. Stud assemblies shall consist of an all-thread anchor rod with nut and washer. Anchors shall be Hilti, HIT C-20 System or equal.

G. Automatic end welded headed anchor studs shall be flux ended studs made from cold drawn steel, ASTM A108 Grades C-1010 through C-1020. Headed anchor studs shall be Nelson, H4L Headed Concrete Anchors or equal.

H. Machine bolts and nuts shall conform to Federal Specification FF-B-575C. Bolts and nuts shall be hexagon type. Bolts, nuts, screws, washers and related appurtenances shall be Type 316 stainless steel.

I. Toggle bolts shall be Hilti, Toggler Bolt or equal.

2.4 - ALUMINUM STAIR NOSING

A. Shall be AMSTEP Model 341ASR, 4” wide with 83-degree return angle.

B. Tread shall be ¼” thick with lip 1-1/8” from underside, no-trip bevel at back edge.

C. All mounting holes shall be pre-drilled and countersunk.

D. Abrasive filler shall consist of a mixture of aluminum oxide and silicon granules in an epoxy resin and hardener locked into channels in an extruded aluminum alloy 6036-T6 base.

E. Minimum coefficient of friction shall be 1.02 (dry) and 0.98 (wet) per ASTM F-609.

F. Color shall be as selected by Owner.

PART 3 - EXECUTION

3.1 - INSTALLATION

A. Install all items except those to be embedded in concrete or other masonry which shall be installed under Division 3 and Division 4 respectively. Items to be attached to concrete or masonry after such work is completed shall be installed in accordance with the details shown. Fastening to wood plugs in masonry will not be permitted.

B. Specialty products shall be installed in accordance with the manufacturer's recommendations.

C. Where aluminum contacts masonry or concrete, apply a heavy coat of approved alkali resistant paint to the masonry or concrete.

END OF SECTION

DIVISION 6

WOOD

NOT USED

DIVISION 7

THERMAL AND MOISTURE PROTECTION

SECTION 07920

JOINT SEALANTS

PART 1- GENERAL

1.01 DESCRIPTION

A. Scope of Work: Caulking and sealants.

1.02 SUBMITTALS

A. Submit for approval product data, samples, guarantees, and certification of all materials specified, in accordance with Section 01340.

1.03 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Materials shall be stored and handled so as to prevent the inclusion of foreign matter or the damage of materials by water, heat, sunlight or breaking, and shall be stored in original containers until ready for use. Material showing evidence of damage shall be rejected.

1.04 WARRANTY AND GUARANTEES

A. Submit a written two (2) year guarantee on sealant type caulking work against joint failure. Joint failure is defined as: leaks of air or water; evidence of loss of adhesion between sealant and joint edge; evidence of loss of cohesion, fading of sealant material; migration of sealant. Refer to Section 01740 for additional requirements.

PART 2 - PRODUCTS

2.01 MATERIALS, GENERAL

A. General: Sealants of formulation and qualities indicated that are recommended for applications indicated and that accommodate indicated percentage change in joint width existing at time of installation without failing either adhesively or cohesively.

B. Compatibility: Provide joint sealants, joint fillers, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.

C. Colors: Provide color of exposed joint sealants to comply with the following:

1. Provide selections made by Architect from manufacturer's full range of standard colors for products of type indicated.

2.02 EXTERIOR BUILDING JOINT SEALANTS

A. Exterior Building Joints, General: One-part silicone sealant, FS- TT -S-00230C, Type II - non-sag, Class A; color as selected:

1. Elongation Capability ±50%
2. Service Temperature Range -40 to 180° F
3. Shore A Hardness Range 20 to 35

B. Glazing Joints - Non-Structural: One-part silicone sealant, FS-TT-S-00230C, Type II, non-sag, Class A; clear:

1. Elongation Capacity +50%
2. Service Temperature Range -40 to 180°F
3. Shore A Hardness Range 20 to 35

C. Embedded Non-Exposed Joints, Sill Members, Splice Covers, Thresholds, Etc.: One-part butyl, polyurethane or polyisobutylene sealant, complying with FS TTS-1657, Type 1:

1. Elongation Capacity +5%
2. Service Temperature Range o to 180^0P

D. Exposed Horizontal Expansion Joints Subject to Pedestrian and Light Vehicular Traffic: Multi-component polyurethane sealant, self-leveling, traffic grade.

1. Elongation Capacity +25%
2. Service Temperature Range -40 to 200°F
3. Shore A Hardness Range 20 to 35

E. Exposed Horizontal Control Joints Subject ~o Vehicular and Wheeled Traffic: Multi-component epoxy sealant, pourable, non-primed.

1. Elongation Capacity ±10%
2. Service Temperature Range -40 to 200°F
3. Shore A Hardness Range 70 to 90

2.03 INTERIOR BUILDING JOINT SEALANTS

A. Interior Building Joints, General: One-part, nonsag, mildew-resistant, paintable sealant of formulation indicated:

1. Solvent-release-curing acrylic terpolymer sealant complying with FS TTS-00230.

2. Acrylic-emulsion sealant complying with ASTM C 834 that accommodates joint movement of not more than 5 percent in both extension and compression for a total of 10 percent.

3. Silicone emulsion sealant complying with ASTM C 834 and, except for weight loss measured per ASTM C 792, with ASTM C 920 that accommodates joint movement of not more than 25 percent in both extension and compression for a total of 50 percent.

4. Butyl sealant complying with ASTM C 1085 and formulated with minimum of 75 percent solids to be nonstaining, paintable, and have a tack-free time of 24 hours or less.

B. Acoustical Sealant for Exposed Joints: Nonsag, paintable, nonstaining latex sealant complying with ASTM C 834 and the following requirements:

1. Product is effective in reducing airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies per ASTM E 90.

C. Acoustical Sealant for Concealed Joints: Nondrying, nonhardening, nonskinning, nonstaining, gunnable, synthetic rubber sealant recommended for sealing interior concealed joints to reduce transmission of airborne sound.

2.04 TAPE SEALANTS

A. Tape Sealant: Solvent-free, butyl-based tape sealant with a solids content of 100 percent formulated to be nonstaining, paintable, and nonmigrating in contact with nonporous surfaces with or without reinforcement thread to prevent stretch and packaged on rolls with a release paper on one side.

3.01 PREPARATION

A. Joints:

1. All joints shall be thoroughly cleaned; loose particles shall be blown out or vacuumed from joints. Material to be contacted by sealant shall be dry, fully free of laitance, loose aggregate, form release agents, curing compounds, water repellents and other surface treatments.

2. Joint packing shall be installed in all joints to receive sealant where required. Packing shall be sized to require 20 to 50 percent (20% - 50%) compression upon insertion, and shall be placed so that sealant depth is approximately one-half (112) joint width. In joints not of sufficient depth to allow packing, polyethylene bondbreaking tape shall be installed at back of joint. Lengthwise stretching of packing materials shall be avoided.

3. Masking tape shall be applied where required to protect adjacent surfaces. Tape shall be adhered in continuous strips in alignment with joint edge and removed immediately after joints have been sealed and tooled.

4. Joints shall be primed where required by sealant manufacturer, to receive sealant in accordance with manufacturer's instructions. Primer shall be brushed uniformly upon all surfaces of joint. Sufficient drying time shall be allowed before caulking.

3.02 APPLICATION

A. Sealant:

1. Mixing and application of sealant shall be as recommended by sealant manufacturer.

2. Material which has exceeded the manufacturer's recommended potential open time (POT Life) shall not be used.

3. Sealant and caulking material shall be applied under pressure to fill joints completely with prevention of air pockets or voids. Tooling shall be performed with solvent recommended by manufacturer. Joints shall be tooled concave.

B. Locations:

1. Sealants shall be applied around penetrations of floor slabs and walls for piping, conduits, ductwork and similar items, at top of slabs and exterior face of walls, around perimeter of door frames and windows, louvers and vents, and at other locations shown on the Drawings. Thresholds shall be set in full bed of sealant.

C. Cleaning: Adjacent surfaces shall be cleaned free of sealant and soiling resulting from this work and as work progresses, using solvent or cleaning agent as recommended by the manufacturer. All finished work shall be left in a neat, clean condition. Where any sealant material will permanently stain surfaces, these surfaces shall be masked out to prevent such staining.

END OF SECTION

DIVISION 8

DOORS AND WINDOWS

NOT USED

DIVISION 9

FINISHES

SECTION 09900

PAINTING

PART 1 - GENERAL

1.1 - SUMMARY

A. Section Includes: Preparation of surfaces, shop painting of items furnished, field painting of new and existing structures, piping, and equipment and masonry waterproofing.

B. The areas to be recoated are generally classified and described as follows

1. Non-H2S Environment Area – The atmosphere within these areas generally do not contain hydrogen sulfide (H2S) gas.
    a. Motor Room (containing the Wastewater Pump Electric Motors)
    b. Pump Room (containing the Wastewater Pumps)
    c. New Electrical Building
    d. Exterior Areas
2. H2S Environment Area - The atmosphere within these areas generally contain hydrogen sulfide (H2S) gas.
    a. Screen Room
    b. Wet Well Mezzanine
    c. Wet Well
    d. Influent Flow Splitter Box

1.2 - REFERENCES

A. Codes and standards referred to in this Section are:

1. SSPC - Steel Structures Painting Manual
2. SSPC SP 1 - Solvent Cleaning
3. SSPC SP 3 - Power Tool Cleaning
4. SSPC SP 6 - Commercial Blast Cleaning
5. SSPC SP 7 - Brush-Off Blast Cleaning
6. SSPC SP 10 - Near-White Blast Cleaning
7. ICRI - International Concrete Repair Institute
8. JEA “Water & Wastewater Standards” Manual Section 447 – “Water Wastewater Protective Coatings”, latest.

1.3 - SUBMITTALS

A. Provide all submittals, including the following, as specified in the General Conditions.

1. Submit shop drawings per the General Conditions.
2. Submit manufacturer's standard color chart for color selection.
3. Where equipment is customarily shipped with a standard finish, submit samples of the proposed color and finish for approval prior to shipping.

4. Furnish affidavits from the manufacturer certifying that materials furnished conform to the requirements specified and that paint products have been checked for compatibility.

5. Submit a supplementary schedule of paint products with mil thickness and solids by volume, including all paint applied in the shop and in the field. Provide a schedule that is in accordance with the recommendations of the paint manufacturer.

1.4 - PAINTING REQUIREMENTS

A. Stainless steel and galvanized components shall not be painted.

B. Shop Primed and Finished Items: Furnish the following items with the manufacturer's standard prime and finish coats applied in the shop: pumps, motors, gears, gear housings, air compressors, wall fans, temperature control and instrument panels, process air blowers, engines, filters, strainers, air dryers, meters, generators, panelboards, transformers, condensing units, condensers, air handling units, sound attenuators, air conditioning and dehumidification units, convector cabinets, unit heaters, aluminum fascia, motor control centers, aluminum light standards, hoisting equipment.

C. Shop Primed and Field Painted Items: Furnish the following items shop primed and field painted: structural steel and wrought metals, steel joists and joist girders, composite metal floor deck, pipelines, hangers and supports, sluice gates, valves, valve and sluice gate operators and stands, guard housings, effluent strainers, air receivers, tanks, air silencing equipment, storage tanks, steel stair framing, steel lintels, hollow metal doors and frames.

D. Field Primed and Finished Items: Field prime and finish, where exposed to view, all items not shop primed or shop finished. This Work generally includes, but is not limited to, the following: gypsum wallboard, interior and exterior concrete block, interior and exterior concrete walls, columns, beams and ceilings, covering over insulation on piping, electrical conduit systems, small piping and copper tubing, ducts, covering over ducts, exterior PVC piping valves, and fittings, drain piping, engine exhaust muffler and piping, and any other additional items indicated on the drawings.

E. Unpainted Items: Do not paint the following items, unless otherwise specified: interior structural steel not exposed to view, registers, grilles, dampers and linkage, fire sprinklers, name and identification plates and tags, floor gratings, brass pipe and fittings, brass valves, stainless steel, wood, cast-iron piping installed underground, stop log panels, spray-on fireproofing, steel to receive spray-on fireproofing, surfaces to receive field welding, faying surfaces of high strength bolted connections, steel to be embedded or in contact with cast-in-place concrete, and anodized aluminum work.

F. Previously Painted Items: Remove all chalk, dust, dirt, mold, mildew down to either bare substrate or sound, well-adhered existing coating. Abrasive-blast all surfaces to assure proper adhesion of new coating. Fill/repair all cracks, voids, penetration openings no longer in use with non-shrink grout or paintable silicone-type sealant. Prepare substrate in strict accordance with the coating manufacturer’s recommendations.

1.5 - DELIVERY, STORAGE AND HANDLING

A. General: Deliver, store, and handle all products and materials as specified in the General Conditions and as specified herein.

B. Delivery and Storage: Only those coatings that are intended for use on this project shall be stored at the project site.

C. Packaging and Labeling: Prepare, pack and label paints, stains, varnish or ingredients of paints to be used on the job. Deliver all material to the site in original, unbroken containers.

D. Storage: Store the painting materials at the site in accordance with applicable codes and regulations and in accordance with manufacturer's instructions. Keep the storage space clean at all times. Take every precaution to eliminate fire hazards.

E. Colors: Prime coats shall be tinted to easily differentiate between coats. Final coats shall be colors as selected by OWNER.

1.6 - WARRANTY

A. Manufacturer shall provide a 5-year warranty per the requirements of JEA Standards, Section 447 - “Water Wastewater Protective Coatings.”

PART 2 - PRODUCT

2.1 - MANUFACTURERS

A. Acceptable manufacturer – Tnemec Company, Inc.

2.2 - MATERIALS

A. General: Furnish paint and other materials of the type and quality of the manufacturer on which the painting schedule specified herein is based.

1. Provide compatible shop and field coats.
2. Provide all coats of paint for any particular surface from the same manufacturer.
3. Provide paint of approved color as selected from the manufacturer's standard range of colors.

2.3 - PAINT SCHEDULE

	Paint System (see paragraph 2.4)				
Area or Room	**CMU/Concrete Wall**	**Concrete Floor/Stairs**	**Piping/Pumps /Equipment**	**Other Ferrous Metal, except Stainless Steel**	**Aluminum in Contact w/Incompatible Materials**
Motor Room	5 (CMU)/6 (concrete)	8	2	3	9
Pump Room	5 (CMU)/6 (concrete)	8	2	3	9
Screen Room	12	14	10	11	9
Mezzanine	12	14	10	11	9
Wet Well	13	13	10	11	9
Influent Flow Splitter Box	13	13	10	11	9
New Electrical Bldg	6	8	2	3	9
Exterior Areas	7	-	-	4	9
NOTE: STAINLESS STEEL IS NOT TO BE COATED					

2.4 - PAINT SYSTEMS

A. PAINT SYSTEM 1 (Non-H_2S Environment, New Factory-Primed Equipment)

1. Factory primer shall be Tnemec Series 1 Omnithane at 2.5 – 3.5 mils DFT or Tnemec Series 66HS Hi-Build Epoxoline at 3.0 – 5.0 mils DFT.
2. Power Tool Clean per SSPC-SP3 all areas to be coated. All surfaces must be thoroughly and uniformly abraded prior to coating.
3. All surfaces must be clean and dry prior to the application of any coatings.
4. Spot Prime: Spot prime with one (1) coat of Tnemec Series 27WB Typoxy inorganic Hybrid water-based epoxy coating at 4.0 – 6.0 mils DFT. Featheredge bare areas to tightly adhered coating.
5. Intermediate Coat: Apply (1) coat of Tnemec Series 27WB Typoxy inorganic Hybrid water-based epoxy coating at 4.0 – 6.0 mils DFT.
6. Finish Coat:
    a. For interior equipment: Apply (1) coat of Tnemec Series 66HS Hi-Build Epoxoline modified polyamide epoxy at 8.0-10.0 mils DFT.
    b. For exterior equipment: Apply (1) coat of Tnemec Series 740 UVX at 8.0 - 10.0 mils DFT.

B. PAINT SYSTEM 2 (Non-H_2S Environment, Existing Ductile Iron Pipe - Interior Previously Coated)
1. Surface preparation:
    a. Remove all grease, oil, dirt and contaminants before proceeding. A cleaning detergent such as Tri-sodium Phosphate must be utilized to facilitate cleaning. A degreaser shall be used for oil soaked areas.
    b. Sweep Abrasive Blast per SSPC-SP7 or Power Tool Clean per SSPC-SP3 to remove all loose chalk, paint, surface contaminants, etc. before proceeding. Thoroughly and uniformly abrade <u>all</u> existing coating and all bare areas.
    c. Feather-edge to existing tight coating.
2. Spot Prime: Spot prime all bare areas with one (1) coat of Tnemec Series 27WB Typoxy inorganic Hybrid water-based epoxy coating at 4.0 – 6.0 mils DFT. Feather to well adhered coating.
3. Prime overall with Tnemec Series 135 Chembuild a modified Polyamidoamine epoxy at 3.0 – 5.0 mils dft.
4. Finish Coating: Confirm with Owner whether a gloss or semi-gloss finish is desired. Gloss finish: Apply (2) coats of Tnemec Series 1028 Enduratone HDP acrylic polymer at 2.0-3.0 mils d.f.t. Semi-gloss finish: Tnemec Series 1029 Enduratone at the same thickness.

C. PAINT SYSTEM 3 (Non-H_2S Environment, New or Existing Steel – Interior, Non-Immersion Service)
1. Surface preparation: Power tool clean any bare or rusted areas. Feather to well adhered coating. Prime any bare areas before rust bloom forms. A 1.5 mil minimum angular blast profile is required.
2. Spot prime all bare and rusted areas with Tnemec Series 135 Chembuild a modified Polyamidoamine epoxy at 3.0 – 5.0 mils dft.
3. Prime overall with Tnemec Series 135 Chembuild a modified Polyamidoamine epoxy at 3.0 – 5.0 mils dft.

4. Finish Coating: Confirm with Owner whether a gloss or semi-gloss finish is desired. Gloss finish: Apply (2) coats of Tnemec Series 1028 Enduratone HDP acrylic polymer at 2.0-3.0 mils d.f.t. Semi-gloss finish: Tnemec Series 1029 Enduratone at the same thickness.

D. PAINT SYSTEM 4 (Non-H_2S Environment, Exterior)

1. Surface Preparation: Remove all grease, oil, dirt and contaminants by pressure washing with minimum 3500 psi @ 3 to 5 gpm using potable water before proceeding. A cleaning detergent such as Trisodium Phosphate or similar must be utilized to facilitate cleaning. A degreaser maybe required for oil soaked areas. All oil residues must be removed before proceeding with any surface preparation. Sweep abrasive blast overall per SSPC SP7 to remove all loose coating and provide a uniform anchor profile of no less than 1.5 mils. Spot blast all bare areas to a minimum SSPC-SP6 Commercial Grade Finish. Feather all bare areas to tightly adhered existing coating.
2. All surfaces must be clean and dry prior to the application of any coatings.
3. Spot Prime: Spot prime all bare areas and stripe welds and edges with 1 coat of Tnemec Series 135-1243 Chembuild modified polyamidoamine epoxy coating at 4.0 – 6.0 mils dft.
4. First Coat: Apply (1) coat overall of Tnemec Series 135-1243 Chembuild modified polyamidoamine epoxy coating at 4.0 – 6.0 mils dft. Use an alternate color from the finish.
5. Finish Coat: Apply (1) coat overall of Tnemec Series 1095 Endura-Shield aliphatic acrylic polyurethane coating at 2.5 – 4.0 mils dft.

E. PAINT SYSTEM 5 (Non-H_2S Environment, Existing Concrete Block - Interior - previously coated)

1. Surface preparation:
    a. Remove all chalk, dirt, dust, loose cementitious coatings, mold, mildew, and other soluble contaminants by high pressure water blast cleaning (minimum 3500 p.s.i. @ 3 to 5 gpm using potable water). A cleaning detergent such as Trisodium Phosphate shall be utilized to facilitate cleaning.
    b. All surfaces must be clean, dry and thoroughly degreased prior to the application of any coatings.
    c. Abrade existing coatings before proceeding.
2. Patching Bare Areas: Prime all bare areas or areas where the existing coating has been removed with Tnemec Series 151 Elasto-Grip FC waterborne modified polyamine epoxy at 0.75 – 1.5 mils dft. Approximately 300 – 350 sq ft per gallon.
3. Finish Coating: Confirm with Owner whether a gloss or semi-gloss finish is desired. Gloss finish: Apply (2) coats of Tnemec Series 1028 Enduratone HDP acrylic polymer at 2.0-3.0 mils d.f.t. Semi-gloss finish: Tnemec Series 1029 Enduratone at the same thickness.

F. PAINT SYSTEM 6 (Non-H_2S Environment, Existing Concrete - Interior - previously coated (all concrete, ceilings, pre-cast, stucco or poured-in-place areas excluding CMU)

1. Surface preparation:
    a. Remove all chalk, dirt, dust, loose cementitious coatings, mold, mildew, and other soluble contaminants by high pressure water blast cleaning

(minimum 3500 p.s.i. @ 3 to 5 gpm using potable water). A cleaning detergent such as Trisodium Phosphate shall be utilized to facilitate cleaning.

b. All surfaces must be clean, dry and thoroughly degreased prior to the application of any coatings.

c. Abrade existing coatings before proceeding.

2. Patching Bare Areas: Prime all areas with Tnemec Series 151 Elasto-Grip FC waterborne modified polyamine epoxy at 0.75 – 1.5 mils dft. Approximately 300 – 350 sq ft per gallon.

3. Coating: Confirm with Owner whether a gloss or semi-gloss finish is desired. Gloss finish: Apply (2) coats of Tnemec Series 1028 Enduratone HDP acrylic polymer at 2.0-3.0 mils d.f.t. Semi-gloss finish: Tnemec Series 1029 Enduratone at the same thickness.

G. PAINT SYSTEM 7 (Non-H_2S Environment, New or Existing Concrete Block – Exterior)

1. Surface preparation:

a. Remove all chalk, dirt, dust, loose cementitious coatings, mold, mildew, and other soluble contaminants by high pressure water blast cleaning (minimum 3500 psi @ 3 to 5 gpm using potable water). A cleaning detergent such as Trisodium Phosphate may be utilized to facilitate cleaning.

b. The areas of efflorescence may require a soft brush to help remove.

c. All surfaces must be clean and dry prior to the application of any coatings.

2. First Coat: Apply one coat (1) Tnemec Series 180 wb Tneme-Crete acrylic emulsion at 6.0 - 8.0 mils DFT.

3. Second Coat: Apply one (1) coat Tnemec Series 180 wb Tneme-Crete acrylic emulsion at 6.0 - 8.0 mils DFT. NOTE: Owner may require a “sand texture” finish. If a “sand texture” finish is required use Tnemec Series 181 at the same film thickness and number of coats.

H. PAINT SYSTEM 8 (Non-H_2S Environment, New or Existing Interior Concrete Floor)

1. Surface preparation:

a. Allow new concrete to cure a minimum 28 days at 75^0F. Power wash to remove laitance and any loose materials, dirt and containments.

b. Acid-etch or mechanically abrade concrete to remove laitance and create a profile. If acid etching, no contaminants such as form release agents, curing compounds, sealers, hardeners, old coatings or other contaminants shall be present as they impede the acid’s ability to properly etch and profile the floor.

c. If any of these conditions exist then a mechanical means, such as sweep abrasive blasting or mechanical abrading, will be required to remove the above.

d. Large voids or other cavities should be filled with a recommended filler or surfacer. Reference SSPC-SP13/NACE 6 with an ICRI CSP1-3.

e. Verify dryness by testing for moisture with a “plastic film tape-down test” (ASTM D4263).

f. All surfaces must be clean and dry prior to the application of any coatings.

2. Primer Coat: Tnemec Series 287 Enviro-Pox at 3.0 - 5.0 mils DFT.
3. Intermediate Coat: Tnemec Series 287 Enviro-Pox at 3.0 - 5.0 mils DFT.
4. Finish Coat: Tnemec Series 290 CRU aliphatic polyester polyurethane at 2.0 - 3.0 mils DFT; add Tnemec Series 211-0212 to provide a non-skid surface.

I. PAINT SYSTEM 9 (Non-H_2S Environment, New or Existing Aluminum in contact with incompatible materials)

1. Surface preparation:
    a. Roughen the surface to be coated.
2. Coating system
    a. Apply two (2) coats of Tnemec Series 46-465 Tneme-Tar at a minumum 10.0 mils DFT/coat.

J. PAINT SYSTEM 10 (H_2S Environment, New Factory-Primed Equipment)

1. Factory primer shall be Tnemec Series 1 Omnithane at 2.5 – 3.5 mils DFT or Tnemec Series 66HS Hi-Build Epoxoline at 3.0 – 5.0 mils DFT.
2. Power Tool Clean per SSPC-SP3 all areas to be coated. All surfaces must be thoroughly and uniformly abraded prior to coating.
3. All surfaces must be clean and dry prior to the application of any coatings.
4. Spot Prime: Spot prime with one (1) coat of Tnemec Series 27WB Typoxy inorganic Hybrid water-based epoxy coating at 4.0 – 6.0 mils DFT. Featheredge bare areas to tightly adhered coating.
5. Intermediate Coat: Apply (1) coat of Tnemec Series 27WB Typoxy inorganic Hybrid water-based epoxy coating at 4.0 – 6.0 mils DFT.
6. Finish Coat:
    a. For interior equipment: Apply (1) coat of Tnemec Series 66HS Hi-Build Epoxoline modified polyamide epoxy at 8.0-10.0 mils DFT.
    b. For exterior equipment: Apply (1) coat of Tnemec Series 740 UVX at 8.0 - 10.0 mils DFT.

K. PAINT SYSTEM 11 (H_2S Environment, Existing Steel – Previously Coated)

1. Surface preparation:
    a. Remove all grease, oil, dirt, dust, mold, mildew, chemical contamination and other soluble contaminants by high pressure water cleaning (minimum 40,000 psi using potable water). A cleaning detergent such as Trisodium Phosphate must be utilized to facilitate cleaning. Check for chemical contamination before proceeding.
    b. Sweep abrasive blast the area to roughen the entire surface before proceeding. This is necessary to provide a profile for the subsequent topcoat and remove all loose or poorly adhered paint. This can be done with dry abrasive or with a water and sand injection. Check ph and neutralize as required to acceptable pH as specified by the coating system manufacturer.
    c. Provide a surface profile similar to an ICRI CSP 2 or 100 grit sandpaper.
    d. For areas that are previously coated, sweep abrasive blast overall to provide a minimum 1.5 mil profile.

e. Bare concrete should read a pH of 9-11.

f. All surfaces must be clean, dry and thoroughly degreased prior to the application of any coatings. Apply first coat as soon as possible to avoid surface contamination.

g. Abrade existing coatings before proceeding.

2. Spot Prime: Spot prime all bare areas with one coat (1) Tnemec Series 104 H.S. Epoxy cycloaliphatic amine epoxy applied @ 3.0 – 6.0 mils DFT.

3. First Coat: Apply one coat (1) Tnemec Series 104 H.S. Epoxy cycloaliphatic amine epoxy applied @ 3.0 – 6.0 mils DFT. Tint to a different color than the finish.

4. Finish Coat: Apply one coat (1) Tnemec Series 104 H.S. Epoxy cycloaliphatic amine epoxy @ 6.0-8.0 mils DFT. Color to be selected by Owner.

L. PAINT SYSTEM 12 (H_2S Environment, New or Existing Concrete and CMU – Interior, Non-submerged)

1. Surface preparation:

a. Remove all grease, oil, dirt, dust, mold, mildew, chemical contamination and other soluble contaminants by high pressure water cleaning (minimum 40,000 psi using potable water). A cleaning detergent such as Trisodium Phosphate must be utilized to facilitate cleaning. Check for chemical contamination before proceeding.

b. Sweep abrasive blast the area to roughen the entire surface before proceeding. This is necessary to provide a profile for the subsequent topcoat and remove all loose or poorly adhered paint. This can be done with dry abrasive or with a water and sand injection. Check ph and neutralize as required to acceptable pH as specified by the coating system manufacturer.

c. Provide a surface profile similar to an ICRI CSP 2 or 100 grit sandpaper.

d. For areas that are previously coated, sweep abrasive blast overall to provide a minimum 1.5 mil profile.

e. Bare concrete should read a pH of 9-11.

f. All surfaces must be clean, dry and thoroughly degreased prior to the application of any coatings. Apply first coat as soon as possible to avoid surface contamination.

g. Abrade existing coatings before proceeding.

2. Resurfacing: Resurface entire area with Tnemec Series 215 Surfacing Epoxy modified polyamine epoxy, 63 mils DFT (1/16”).

3. First Coat: Tnemec Series 104 H.S. Epoxy cycloaliphatic amine epoxy thinned 10% and applied @ 3.0 – 6.0 mils DFT. Tint first coat to a different color than the finish.

4. Finish Coat: Tnemec Series 104 H.S. Epoxy cycloaliphatic amine epoxy @ 6.0-8.0 mils DFT. Color to be selected by Owner.

M. PAINT SYSTEM 13 (H_2S Environment, Existing Concrete – Wetwell Interior)

1. Surface preparation shall consist of removal of all grease, oil, dirt, dust, mold, mildew, chemical contamination and other soluble contaminants by high pressure water cleaning (minimum 40,000 psi using potable water). A cleaning detergent

such as Trisodium Phosphate must be utilized to facilitate cleaning. Check for chemical contamination before proceeding.

2. These areas to receive coating system in accordance with JEA "Water & Wastewater Standards", "Specialty Coatings and Linings –Section 446".

N. PAINT SYSTEM 14 (H_2S Environment, New or Existing Interior Concrete Floor)

1. Surface preparation:

a. Remove all grease, oil, dirt, dust, mold, mildew, chemical contamination and other soluble contaminants by High Pressure Water Cleaning (minimum 3500 psi, 3 to 5 gallons per minute, potable water). This procedure can be omitted if Hydro blasting is utilized. A cleaning detergent such as Trisodium Phosphate must be utilized to facilitate cleaning. Check for chemical contamination before proceeding.

b. Sweep abrasive blast the area to roughen the entire surface before proceeding. This is necessary to provide a profile for the subsequent topcoat and remove all loose or poorly adhered paint. This can be done with dry abrasive or with a water and sand injection. Check ph and neutralize as required to acceptable pH as specified by the coating system manufacturer.

c. Provide a surface profile similar to an ICRI CSP 3.

d. For areas that are previously coated, sweep abrasive blast overall to provide a minimum 1.5 mil profile.

e. Bare concrete should read a pH of 9-11.

f. All surfaces must be clean, dry and thoroughly degreased prior to the application of any coatings. Apply first coat as soon as possible to avoid surface contamination.

g. Abrade existing coatings before proceeding.

2. First Coat: Apply one coat (1) Tnemec Series 201 Epoxoprime modified polyamine epoxy applied @ 6.0 – 10.0 mils DFT.

3. Apply one coat (1) Tnemec Series 280 Tneme-Glaze modified polyamine epoxy at 6.0-10.0 mils DFT; add Tnemec Series 211-0212 to provide a non-skid surface.

PART 3 - EXECUTION

3.1 - PREPARATION

A. Inspection: Prior to surface preparation perform the following:

1. Verify that surface substrate conditions are ready to receive Work as instructed by the product manufacturer.

2. Examine specifications for all Work and become thoroughly familiar with all provisions regarding painting.

B. Surface Preparation: After inspection and prior to painting, perform the following:

1. Inspect all Work prior to application of any paint or finishing material.

2. Prepare the surface to be painted in accordance with the instructions of the manufacturer and as approved.

3. Brush and wash concrete surfaces and concrete masonry. Remove all loose dirt, free lime, form oil, curing compounds and other foreign matter by approved methods. Patch concrete surfaces requiring repair and spackle and repair surfaces

to receive paint. Acid etch concrete surfaces to be painted as recommended by the manufacturer of the coating to be applied, to produce a slightly granular surface required for adherence of the paint to the concrete unless otherwise indicated. Note ICRI guidelines. Determine that concrete and concrete masonry is thoroughly dry prior to painting.

4. Thoroughly clean surfaces to be given protective coatings.
5. Refinish shop-coated equipment that has scratches and abrasions.
6. Do not begin field painting prior to approval of the surface preparation.
7. Thoroughly clean wood surfaces to remove all foreign matter. Properly fill and smooth cracks and nail holes. Finish exposed wood with sandpaper to a fine finish and wipe clean of dust.
8. Prepare and clean all surfaces prior to painting, as specified and required. Verify that surfaces are dry before any paint is applied. Perform special surface preparation work as directed by the manufacturer of the paint specified to be applied to the surface. Follow dew point limitations
9. Clean the surface of structural steel, exterior and interior dry surfaces of water storage tanks and steel encased in concrete, masonry or spray-on fireproofing by removing all rust, mill scale, oil, grease or dirt in accordance with Steel Structures Painting Council SSPC-SP6.
10. Prior to coating interior surfaces and steel components, grind smooth all welds, beads, blisters or protuberances, other than identification markings and remove other imperfections. Remove all rust, mill scale, oil, grease and dirt by sandblasting in accordance with Steel Structures Painting Council Near White SSPC-SP-10 unless otherwise indicated. Follow manufactures requirements for required blast profile.
11. Prior to painting metals other than steel, grind smooth all welds, beads, blisters of protuberances, other than identification markings, and remove other imperfections. Solvent clean all nonferrous metals, galvanized steel and stainless steel whether shop primed or field primed, in accordance with SSPC-SP-1 prior to the application of the primer.
12. Prime cleaned metal the same day immediately after sandblasting to prevent rusting.
13. Remove all adhering debris on pipe and duct covering and smooth out indentations or unsightly spots and brush clean.
14. Remove all bituminous or asphaltic coating from cast iron drain and soil pipe prior to painting.
15. Prepare gypsum wallboard as recommended by the wallboard manufacturer.
16. Remove all adhering debris on PVC, thoroughly and uniformly abrade the surface before coating. Remove any dirt before proceeding. Roughen surface with sandpaper and brush clean.

3.2 - INSTALLATION

A. General: Install all painting and coatings in accordance with the manufacturer's recommendations and approved shop drawings and as specified in Division 1.

1. Apply products in accordance with the latest edition of AWWA D102 and the manufacturer's instructions.
2. Refer to manufacturers literature for minimum application temperatures.

3. Paint or finish all surfaces that are left unfinished by the requirements of other specifications and specified herein to be painted or finished.
4. Paint surfaces in accordance with the material painting schedule included in this Section.
5. Completely cover all surfaces to be painted. Cover by additional coats when color on undercoats shows through the final coat of paint, until paint is of uniform color and appearance and coverage is complete.
6. Do not apply exterior coatings during rain or snow, or when relative humidity is outside the humidity ranges required by the paint product manufacturer.
7. Provide sufficient temporary ventilation during painting operations in enclosed areas to remove moisture and solvents, and to keep the atmosphere safe from harmful or dangerous fumes and dust levels for personnel.

B. Touch-Up Shop-Primed and Finished Items: Touch-up all damaged portions and imperfections in shop-primed and finished items. Use the same paint as used for the shop prime and finish. Prepare the surface prior to touch-up by wire brushing and sanding to remove rust, scale and loose paint.

C. Aluminum and Incompatible Surfaces: Where aluminum surfaces come in contact with incompatible metals, lime, mortar, concrete or other masonry materials, apply one field coat of Tnemec Series 66HS Hi-Build Epoxoline.

D. Steel Pipe: Applicable to insulated and uninsulated steel pipe. Immediately after installation, prime all pipe not provided with a shop coat.

E. Field Painting: Perform field painting at the job site as follows:

1. Mix all paints and similar materials in galvanized iron pans or pails or other approved containers of adequate capacity.
2. Mix all paint thoroughly before being taken from the containers. Keep mixed while painting. Apply all ready-mixed paint exactly as received from the manufacturer without addition of any kind of drier or thinner, except as specified, to mix colors to conform to approved color schedule. Tint successive coats of paint to make various coats easily distinguishable. Tint undercoats of paint to the approximate shade of the final coat of paint.
3. Use only skilled painters on the Work, and employ specialists where required. Apply paint by brush, roller or sprayer in accordance with the manufacturer's recommendation.
4. Paint top and bottom edges of doors. Thoroughly and uniformly sand undercoats on hollow metal Work with No. 00 sandpaper or equal abrasive to remove all surface defects and provide a smooth, even surface. Do not allow brush marks or other irregularities on finished surfaces.
5. Perform painting as a continuous and orderly operation to facilitate adequate inspection. Prime coat and paint materials subject to weathering or corrosion before erection. Perform all paint application methods in accordance with the instructions of the paint manufacturer and as approved. Do not field paint equipment, such as electrical control cabinets, motors, unit heaters and similar items which are shipped with a final baked enamel finish and having received prior approval unless the finish is damaged in transit or installation. Paint access panels, pipe, pipe covering, ducts and other building appurtenances built into adjoining walls the same color as adjacent walls, unless color coding applies.

Remove or protect hardware and accessories, fixtures and similar items placed prior to painting during painting and replace them upon completion of painting.

6. Paint piping up to and including the flanges attached to mechanical equipment. Paint electrical conduit up to and including the flexible conduit connected to equipment.
7. Paint all wall surfaces which will be concealed by equipment before equipment installation.
8. Fully protect areas under and adjacent to painted Work at all times and promptly remove dripped or spattered paint.
9. Repair, refinish and repaint any adjacent surfaces that have been damaged or discolored by overspray.
10. Do not paint when the air or surface temperature is below that recommended by the manufacturer, or in dust-laden air, or until moisture on the surface has completely disappeared. If necessary, provide sufficient heating and ventilation to keep the atmosphere and all surfaces to be painted dry and warm until each coat of paint has hardened.
11. Remove any painting found defective. Touch-up and provide remedial painting as directed and as required until completion and acceptance of final Work.

3.3 - CLEANING AND PAINTING

A. Touch up and restore any finish damaged. Remove paint or other finishes spilled, splashed or splattered from all surfaces taking care not to mar any surface or item being cleaned.

END OF SECTION

SECTION 09905

EQUIPMENT IDENTIFICATION

PART 1- GENERAL

1.01 DESCRIPTION

A. Scope of Work: The work included under this Section consists of providing an identification system for piping systems and related equipment.

B. Related Work Described Elsewhere:

1. Shop Drawings, Working Drawings, and Samples.

2. Painting: Section 09900

3. Electrical: Division 16.

1.02 QUALITY ASSURANCE

A. Standards: ANSI Standard A13J, Scheme for the Identification of Piping Systems.

1.03 SUBMITTALS

A. Submit manufacturer's descriptive literature, illustrations, specifications, and other pertinent data.

B. Schedules:

1. Provide a typewritten list of all tagged valves giving tag color, shape, letter code and number, the valve size, type, use, and general location.

2. Provide a complete list of materials to be furnished and surfaces on which they will be used.

C. Samples:

1. Provide a sample of each type valve tag supplied.

2. Provide a sample of each type of identification tape supplied.

3. Provide manufacturer's color charts for color selection by Engineer.

1.04 PRODUCTS DELIVERY, STORAGE, AND HANDLING

A. Delivery Of Materials: Except for locally mixed custom colors, deliver sealed containers with labels legible and intact.

B. Storage Of Materials:

1. Store only acceptable project materials on project site.

2. Store in suitable location.

3. Restrict storage to paint materials and related equipment.

4. Comply with health and fire regulations.

1.05 JOB CONDITIONS

A. Environmental Requirements:

1. Comply with manufacturer's recommendations as to environmental conditions under which coatings and coating systems can be applied.

2. Do not apply finish in areas where dust is being generated.

B. Protection: Cover or otherwise protect finished work of other trades and surfaces not to be painted.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Materials for painting shall conform to requirements of Section 09900: Painting.

B. Materials selected for coating systems for each type surface shall be the product of a single manufacturer.

C. Aboveground piping shall be identified by self-adhesive pipe markers equal to those manufactured by W. H. Brady Company.

1. Markers shall be of wording and color as shown in Table 09905.

2. Lettering shall be:

a. 2-1/4-inches high for pipes 3 inches diameter and larger.

b. 1-1/8-inches high for pipes less than 3 inches diameter.

3. Flow arrows shall be:

a. 2-1/4-inches by 6 inches for pipes 3 inches diameter and larger.

b. 1-1/8-inches by 3 inches for pipes less than 3 inches diameter.

D. Buried piping shall be identified by identification tape installed over the centerline of the pipelines.

1. Identification Tape for Steel or Iron Pipe: Identification tape shall be manufactured of inert polyethylene film so as to be highly resistant to alkalies, acids, or other destructive agents found in soil, and shall have a minimum thickness of 4 mils. Tape width shall be 6 inches and shall have background color specified below, imprinted with black letters. Imprint shall be as specified below and shall repeat itself a minimum of once every 2 feet for entire length of tape. Tape shall be Terra Tape Standard 250, or approved equal.

2. Identification Tape for Plastic or Non-Magnetic Pipe: Identification tape shall be manufactured of reinforced polyethylene film with a minimum overall thickness of 4 mils and shall have a 0.35 mil thick magnetic metallic foil core. The tape shall be highly resistant to alkalies, acids, and other destructive agents found in soil. Tape width shall be 3 inches and shall have background color specified below, imprinted with black letters. Imprint shall be as specified below and shall repeat itself a minimum of once every 2 feet for entire length of tape. Tape shall be TerraTape Sentry Line 1350, or approved equal.

3. Tape background colors and imprints shall be as follows:

Imprint	Background Color
"Caution Sewer Line Buried Below"	Green
"Caution Electrical Line Buried Below"	Red
"Caution Water Line Buried Below"	Blue
"Caution Telephone Line Buried Below"	Orange
"Caution Reuse Line Buried Below"	Purple
"Caution Compressed Air Line Buried Below"	Dark Green
"Caution Chemical Line Buried Below"	Yellow

4. Identification tape shall be "Terra Tape" as manufactured by Reef Industries, Inc., Houston, TX; Allen Systems, Inc., Wheaton, IL; or approved equal.

E. Aboveground Valve Identifications: A coded and numbered tag attached with brass chain and/or brass "S" hooks shall be provided on all valves.

1. Tag Types: Tags for valves on pipe shall be brass or anodized aluminum. Colors for aluminum tags shall, where possible, match the color code of the pipe line on which it is installed. Square tags shall be used to indicate normally closed valves and round tags shall indicate normally open valves.

2. Coding: In addition to the color coding, each tag shall be stamped or engraved with wording or abbreviations to indicate the valve service and number. All color and letter coding shall be approved by the Engineer. Valve service shall either be as listed in Table 09905, or by equipment abbreviation if associated with a particular piece of equipment. Valve numbering, if required, shall be as approved by the Engineer and/or Owner.

PART 3 - EXECUTION

3.01 COLOR CODING FOR PIPES AND EQUIPMENT

A. Piping color codes, and code labels for pipe identification shall conform to Table 09905.

B. General Notes and Guidelines:

1. Pipelines, equipment, or other items which are not listed here shall be assigned a color by the Owner and shall be treated as an integral part of the Contract.

2. Color coding shall consist of color code painting and identification of all exposed conduits, through lines and pipelines for the transport of gases, liquids, or semi-liquids including all accessories such as valves, insulated pipe coverings, fittings, junction boxes, bus bars, connectors and any operating accessories which are integral to a whole functional mechanical pipe and electrical conduit system.

3. All moving parts, drive assemblies, and covers for moving parts which are potential hazards shall be Safety Orange.

4. All safety equipment shall be painted in accordance with OSHA Standards.

5. All inline equipment and appurtenances not assigned another color shall be painted the same base color as the piping. The pipe system shall be painted with the pipe color up to, but not including, the flanges attached to pumps and mechanical equipment assigned another color.

6. All pipe hangers and pipe supports shall be painted, unless specified otherwise due to material of construction.

C. All pipe hangers, pipe supports, and accessories shall be painted to match their piping. The system shall be painted up to, but not including, the face of flanges or the flexible conduit connected to electrical equipment. Structural members used solely for pipe hangers or supports shall be painted to match their piping. Where the contact of dissimilar metals may cause electrolysis and where aluminum will contact concrete, mortar or plaster, the contact surface of the metals shall be coated in accordance with Section 09900.

D. All systems which are an integral part of the equipment, that is originating from the equipment and returning to the same piece of equipment, shall be painted between and up to, but not including, the face of flanges or connections on the equipment.

E. All insulated surfaces, unless otherwise specified, shall be given one (1) coat of sizing, one (1) prime coat, and one (1) finish coat.

F. System code lettering and arrows shall conform to the requirements of ANSI A13.1 marked on piping as follows:

1. Legends shall be of the following color for the respective pipe color:

Key to Classification of Predominant Colors For Piping		Color of Letters, if not Otherwise Specified
(F) Fire Protection:	Red	White
(D) Dangerous:	Yellow	Black
	Orange	Black
(S) Safe:	Green	Black
	White	Black
	Black	White
	Light Grey	Black
	Dark Grey	White
	Aluminum	Black
(P) Protective:	Blue	White

2. All piping containing or transporting corrosive or hazardous chemicals shall be identified with labels every 10 feet and with at least two (2) labels in each room. Otherwise, markers shall be placed no more than 20 feet apart with at least one

(1) marker on every straight run and additional markers at turns and where pipes pass through walls.

3. An arrow indicating direction of flow shall be placed adjacent to each marker.

3.02 FABRICATED EQUIPMENT

A. Unless otherwise indicated or specifically approved, all fabricated equipment shall be shop primed and finished. See Section 09900 - Painting.

B. The Contractor shall be responsible for and take whatever steps are necessary to properly protect the shop prime and finish coats against damage.

C. Where specified in other Sections of these Specifications for mechanical equipment, the Contractor shall apply field coats of paint in accordance with Section 09900. If the shop finish coating is unsatisfactory due to poor adhesion or other problems with primer or finish coats, coatings shall be removed and replaced by sandblasting, priming and finishing in accordance with Section 09900 and this Section.

D. Wherever fabricated equipment is required to be sandblasted, the Contractor shall protect all motors, drives, bearings, gears, etc., from the entry of grit. Any equipment found to contain grit shall be promptly and thoroughly cleaned. Equipment contaminated by grit in critical areas, such as bearings, gears, seals, etc., shall be replaced at no cost to the Owner.

3.03 INSTALLATION OF IDENTIFICATION TAPE

A. Identification tape shall be installed for all buried pipelines and conduits in accordance with the manufacturer's installation instructions and as specified herein.

B. Identification tape for piping shall be installed at two (2) locations:

1. One (1) foot below finished grade along centerline of pipe, and;

2. Directly on top of the pipe.

TABLE 09905

COLOR CODES AND ABBREVIATIONS

Service	Conduit, Pipe, and Valve Color Code	Letter and Flow Arrow Color
High Pressure Air	Light Grey	Black
Alum Solution	Orange	Black
Chlorine Solution	Yellow	Black
Gravity Drain	Brown	Black
Filtered Effluent	Dark Green	Black
Force Main	Brown	Black
Mixed Liquor	Brown	Black
Non-Potable Water	Purple	Black
Potable Water	Blue	Black
Return Activated Sludge	Brown	Black
Reuse Water	Purple	Black
Stormwater	Brown	Black
Scum	Brown	Black
Clarified Effluent	Dark Green	Black
Waste Activated Sludge	Brown	Black
Diesel Fuel	OSHA Red	White
Process Air	Light Grey	Black

END OF SECTION

DIVISION 10

SPECIALTIES

NOT USED

DIVISION 11

EQUIPMENT

SECTION 11000

BASIC EQUIPMENT REQUIREMENTS

PART 1 – GENERAL

1.1 Related Sections (where applicable)

A. General Project Requirements - Division 1.

B. Concrete Work - Division 3.

C. Painting - Division 9.

D. Special Requirements – Division 13

E. Electrical Requirements - Division 16.

F. JEA Standards

1.2 Requirements

A. Basic requirements for mechanical installations, including requirements common to more than one section, of Division 11 and to equipment items included in sections of Division 15 as applicable.

B. Supplementary requirements to those specified in sections of Division 1.

1.3 Pipe Location

A. Exterior pipelines will be located substantially as indicated on the drawings, but the right is reserved to the Owner acting through the Engineer, to make such modifications in location as may be determined by field conditions. Where fittings, etc., are noted on the drawings, such notation is for the Contractor's convenience and does not relieve him from laying and jointing different or additional items where required without additional compensation.

B. All piping shown on the drawings, not specifically located by dimension, is indicated diagrammatically and the exact location shall be determined from approved shop drawings. Piping shall be arranged in a neat, compact, and workmanlike manner with a minimum of crossing and interlacing and, in general, without diagonal runs.

C. Small interior piping, generally less than 2" in diameter, is indicated diagrammatically on the drawings and the exact location is to be determined in the field. Piping shall be arranged in a neat, compact, and workmanlike manner, with a minimum of crossing and interlacing, and in general, without diagonal runs.

1.4 Bolts, Anchor Bolts, and Nuts

A. All anchor bolts, anchor bolt templates, and location drawings required for the installation of the equipment, support columns, and for all other equipment or

machinery included under this Contract shall be furnished by the Contractor. Anchor bolts, sleeves, and inserts shall be set in place in forms and cast in the concrete by the General Contractor. It shall be the responsibility of the Contractor to obtain such anchor bolts, templates, and approved location drawings in proper time to avoid delay, and it shall be his further responsibility to check and approve the location and setting of the anchor bolts, sleeves, and inserts prior to the casting of the concrete. Parts of anchors of metal work that are not built into masonry and concrete shall be coated with approved red lead paint. Anchor bolts for column base plates and other structural elements shall be of galvanized steel unless indicated otherwise; anchor bolts for drives, motors, fans, blowers, and other mechanical equipment shall be of 304 stainless steel or high strength bronze. Anchor bolts shall be of ample size and shall be provided with hexagonal nuts of the same quality of metal as the bolts. All threads shall be clean cut and of United States Standard sizes. All anchor bolts and nuts for anchoring equipment exposed to sewage shall be 316 stainless steel.

B. Expansion bolts shall have malleable iron and lead composition elements of the required number of units and size. Expansion bolts, if called for on the drawings, shall be furnished and installed by the Contractor. All expansion bolts exposed to sewage shall be 316 stainless steel.

C. Unless specified otherwise, stud, tap, and machine bolts shall be of the best quality refined bar iron. Hexagonal nuts of the same quality of metal as the bolts shall be used. All threads shall be clean cut and shall conform to ANSI Standard B1.1 latest for “Unified and American Screw Threads for Screws, Bolts, Nuts, and Other Threaded parts”. All bolts exposed to sewage shall be 316 stainless steel.

D. Bolts, anchor bolts, nuts, and washers shall be stainless steel.

E. Anchor bolts and expansion bolts shall be set accurately. Anchor bolts which are set before the concrete has been placed shall be carefully held in suitable templates of approved design provided under this Contract. Where indicated on the drawings, specified, or required, anchor bolts shall be provided with square plates at least 4 inches by 4 inches by 3/8-inch or shall have square heads and washers and be set in the concrete forms with suitable pipe sleeves, or both. If expansion or, with prior approval, anchor bolts are set after the concrete has been placed, all necessary drilling and grouting and caulking shall be done at the Contractor’s expense, and care shall be taken not to damage the structure or finish by cracking, shipping, spalling, or otherwise during the drilling and caulking.

1.5 Concrete Inserts

A. Concrete inserts shall be designed to support safely, in the concrete that is used, the maximum load that can be imposed by the hangers used in the inserts. Inserts shall be of a type which will permit adjustment of the hangers both horizontally (in one plane) and vertically and locking of the hanger head or nut. All inserts shall be galvanized.

1.6 Sleeves

A. Unless indicated otherwise on the drawings or specified, openings for the passage of pipes and conduits through floors and walls shall be formed of sleeves of standard

weight, galvanized steel pipe. The sleeves shall be ample diameter to pass the pipe and its insulation, if any, and to permit such expansion as may occur. Sleeves shall be of sufficient length to be flush at the walls and the bottom of slabs and to project 1 inch above the finished floor surface. Threaded nipples shall not be used as sleeves.

B. Sleeves in exterior walls, below ground, or in walls to have water, sewage, or wastes on one or both sides shall have a 2-inch annular fin of 1/8-inch plate welded with a continuous weld completely around the sleeve at mid-length.

C. All sleeves shall be set accurately before the concrete is placed or shall be built in accurately as the masonry is being built.

1.7 Cutting and Patching

A. The Contractor shall leave all chases or openings for the installation of his own or any other contractor's or subcontractor' work, or shall cut the same in existing work, and shall see that all sleeves or forms are at the work and properly set in ample time to prevent delays. He shall see that all such chases, openings, and sleeves are located accurately and are of proper size and shape and shall consult with the Engineer and the contractors or subcontractors concerned in reference to this work.

B. In case of his failure to leave or cut all such openings or have all such sleeves provided and set in proper time, he shall cut them or set them afterwards at this own expense, but in so doing he shall confine the cutting to the smallest extent possible consistent with the work to be done. In no case shall piers or structural members be cut without the consent and approval of the Engineer.

C. The Contractor shall carefully fit around, close up, repair, patch, and point around the work specified herein to the entire satisfaction of the Engineer.

D. All of this work shall be done by careful workmen competent to do such work and with the proper small hand tools. Power tools shall not be used except where the type of tool proposed can be used without damage to the structure beyond the limits of the work.

E. Except with the consent of the contractor or subcontractor involved, given in writing or in the presence of the Engineer, the Contractor shall not himself, and shall not permit his subcontractors to, cut or alter the work of any other contractor or subcontractor. All cutting and patching or repairing made necessary by the negligence, carelessness, or incompetence of the Contractor or any subcontractor shall be done by the contractor or subcontractor who constructed the work, but such cutting and repairing or patching shall be done at the expense of the contractor at fault.

1.8 Foundations, Installation, and Grouting

A. The Contractor shall furnish the necessary materials and construct suitable concrete foundations for all equipment installed by him at no additional cost to the Owner, even though such foundations may not be indicated on the drawings. The tops of foundations shall be at such elevations as will permit grouting as specified herein. All equipment foundations so required shall be submitted, fully dimensioned, with the shop drawings for such equipment.

B. All equipment shall be installed by skilled mechanics and in accordance with the instructions of the manufacturer.

C. In setting pumps, motors, and other items of equipment customarily grouted, the Contractor shall make an allowance of at least 1 inch for grout under the equipment bases. Shims used to level and adjust the bases shall be metal. Shims may be left embedded in the grout, in which case they shall be brass or bronze and installed so as to be as inconspicuous as possible in the completed work.

D. Grout shall be non-shrink and applied and cured in strict conformance with manufacturer's recommendations. Where practicable, the grout shall be placed through the grout holes in the base and worked outward and under the edges of the base and across the rough top of the concrete foundation to a peripheral form so constructed as to provide a suitable chamfer around the top edge of the finished foundation. Where such procedure is impracticable, the method of placing grout shall be as approved. After the grout has hardened sufficiently all forms, hoppers, and excess grout shall be removed and all exposed grout surfaces shall be patched in an approved manner, if necessary, and given a burlap-ribbed finish.

1.9 Services of Manufacturer's Representative

A. The Contractor shall arrange for a qualified service representative from the company manufacturing or supplying each item of equipment listed in this division to perform the duties herein described.

B. After installation of the equipment has been completed and the equipment is presumably ready for operation, but before it is operated by others, the representative shall inspect, operate, test, and adjust the equipment. The inspection shall include, but shall not be limited to, the following points as applicable.

1. Soundness (without cracked or otherwise damaged parts).

2. Completeness in all details, as specified.

3. Correctness of setting, alignment, and relative arrangement of various part.

4. Adequacy and correctness of packing, sealing, and lubricants.

5. Correction of calibration, etc.

The operation, testing, and adjustment shall be as required to prove that the equipment is in proper condition for satisfactory operation under the conditions specified.

C. While the manufacturer's representative is at the job site he shall also instruct the Owner's personnel in the use and maintenance of the equipment.

D. On completion of his work, the manufacturer's or supplier's representative shall submit in triplicate to the Engineer a complete signed report of the result of his inspection, operation, adjustments, and tests. The report shall include detailed descriptions of the points inspected, tests and adjustments made, quantitative results

obtained if such are specified, and the suggestions for precautions to be taken to ensure proper maintenance. The report also shall include a certificate that the equipment conforms to the requirements of the Contract and is ready for permanent operation and that nothing in the installation will render the manufacturer's warranty null and void. The manufacturer or supplier shall file with his shop drawing submittal an equipment warranty guaranteeing his equipment for a period of one (1) year from date of final acceptance of the equipment by the Owner.

E. In addition to the above requirements, the Contractor shall employ the services of a factory service engineer for the special service specified in the division's subsections.

1.10 Standardization of Grease Fittings

A. The Contractor shall ensure that all grease fittings on all pieces of equipment furnished under this Contract are standardized so that only the zerk type of fitting is used. Fittings shall be standard or giant size according to the type of service to be performed. Unless approved otherwise, all fittings shall be the product of one manufacturer. Fittings which are not readily accessible shall be piped to an accessible location.

1.11 Nameplates

A. With the exceptions mentioned below, each piece of equipment shall be provided with a substantial nameplate of noncorrodible metal, securely fastened in place, and clearly and permanently inscribed with the manufacturer's name, model or type designation, serial number, principal rated capacities, electrical, or other power characteristics, and similar information as appropriate.

B. This requirement shall not apply to standard, manually operated hydrants; gate, globe, check, and plug valves; or accessories and specialties not having an electrical connections.

1.12 Valve Identification and Directories

A. Each shutoff or control valve installed under this Contract shall be provided with 1 1/2-inch minimum diameter heavy brass tag. Each tag shall bear the identifying number of the valve and, when so directed in the Project Specifications and/or on the drawings, an identifying letter symbol of the service line.

B. The tags shall be attached to the valve by split-key rings soldered so that ring and tag cannot be removed. The numbers and letters shall be of block type, with 1/2-inch numbers and 1/4-inch high letters stamped thereon and filled with black enamel.

C. Each buried valve shall have a concrete pad constructed around the valve box with a brass identifying tag embedded in the pad as indicated on the drawings.

D. The Contractor shall furnish and install approved schematic pipe diagrams and valve directories for each piping system. Each schematic pipe diagram shall be single line showing the relative position of valves, valve numbers, and the direction of flow. Each directory shall show each valve number and the location of each valve. Each diagram

and directory shall be on an approved material and framed in a glazed frame with screw eyes and wires for hanging and shall be located as directed by the Engineer.

1.13 Operating Instructions and Parts Lists

A. For each piece of equipment, in accordance with the provisions of the General Conditions and Special Conditions, the Contractor shall furnish complete, neatly bound sets giving the information listed below:

1. Equipment data including: installation, operation, and maintenance instructions, pump curves, factory test reports, startup reports, and other data which may be required for the operation and service of all equipment. These instructions shall include a complete lubrication chart.

2. List of all parts for the equipment, with catalog numbers and other data necessary for ordering replacement parts.

3. In addition to the above, the Contractor, prior to requesting payment for equipment stored on site, shall submit to the Engineer a complete list of maintenance and spare parts requirements as specified below. For each piece of mechanical equipment furnished under this contract, the following information shall be supplied:

a. Complete parts list.

b. Complete set of preventive maintenance requirements as a function of running and/or elapsed time.

c. Complete set of lubrication instructions including schedule and quantity and type of lubricant(s).

d. Complete listing of consumable items sufficient for one year's operation, i.e., light bulbs, belts, etc.

e. Recommended spare parts inventory.

B. Such instructions and parts lists shall have been prepared for the specific equipment furnished and shall not refer to other sizes and types or models of similar equipment.

1.14 Lubricants

A. The Contractor shall furnish all lubricants used during testing and prior to acceptance and, in addition he shall furnish an estimated one (1) year's supply of all grease and oil necessary for the proper lubrication of all equipment furnished under this Contract. Lubricants for this supply shall be furnished in the original sealed containers, each correctly identified as a brand and grade and with reference to the particular piece of equipment for which it is intended.

1.15 Tools

A. For each type of equipment furnished by him, the Contractor shall provide a complete set of all special tools (including grease guns or other lubricating devices for each type of grease) which may be necessary for the adjustment, operation, maintenance and disassembly of such equipment. Tools shall be high-grade, smooth, forged alloy, tool steel.

1.16 Patents

A. The Contractor shall guarantee to the Owner that all equipment offered under these specifications, or that any process resulting from the use of such equipment in the manner stated, is not the subject of patent litigation and that he is not knowingly offering equipment, the installation or use of which is likely to result in a patent controversy, in which the Owner as user is likely to be made the defendant.

B. Where patent infringements are likely to occur, each Contractor shall submit, as a part of his bid, license arrangement between himself, or the manufacturer of the equipment offered, and the patent owner or the controller of the patent, which will permit the use in the specified manner of such mechanical equipment as he may be bidding upon.

C. Each Contractor, by submitting his bid, agrees to hold and save the Owner or it officers, agents, servants, and employees harmless from liability of any nature or kind, including cost and expenses, for, or on account or, any patented or unpatented invention, process, article, or appliance manufactured or used in the performance of the work under this Contract, including the use of same by the Owner.

1.17 Piping and Connections

A. Equipment shall be oriented and connected as indicated on the drawings. Deviations from dimensions and arrangements shown on the drawings caused by equipment characteristics shall be shown on complete dimensioned layouts and submitted by the Contractor to the Engineer for approval prior to installation of the equipment. The approved deviation and all related charges in piping, conduit, supports, etc., shall be made at no additional cost to the Owner.

B. Electrical connections shall be performed as specified under Division 16 - Electrical.

1.18 Electric Motors

A. Unless specified otherwise, all electric motors shall be provided with the driven equipment and shall be as specified in Division 16 - Electrical.

1.19 Electric Variable Speed Drives

A. Unless specified otherwise, all electric variable speed drives (variable frequency, slip recovery, wound secondary resistance, etc.) shall be provided by the variable speed drive manufacturer and shall be as specified in Division 16 - Electrical.

B. It shall be the responsibility of the Contractor to furnish and install a complete coordinated pump, motor, and variable speed drive system in accordance with the intended application and operation.

C. To assist in verification of coordination and proper system performance, the Contractor shall provide the following for review:

1. System data including pump head vs. flow curves, pump hp vs. flow curves (throughout the complete system operating speed range), pump and motor speed vs. torque curves (showing accelerating steps and speed regulation points), etc.

2. Pump data including torque requirements, etc.

3. Motor data including primary and secondary volts, amps, 100% ohms of secondary and resistor bank design (for wound rotor applications), current vs. hp curves, etc.

4. Control data including written intended sequence of operation, interlocking provided, field adjustments available, etc.

1.20 Submission of Approval Data With Bid

A. It shall be the Contractor's responsibility to submit with his bid, or cause to be filed direct with the Engineer prior to the bid date, complete information on the equipment offered. In the case of equipment listed or specified herein, this may be a statement to the effect that the equipment being offered meets the specifications and conforms with the drawings in every detail; any and all exceptions shall be listed so that a decision may be made prior to award, otherwise it will be assumed the equipment conforms to these specifications in every respect.

B. For equipment not listed or specified herein, complete shop drawings and specifications shall be filed listing or showing weights, thicknesses, materials, performance characteristics, etc.

C. For pumps, the manufacturer's information shall show the manufacturer of the motor(s) for all pumps over 50 gpm (design flow), a guaranteed performance curve and/or other data required in the paragraphs delineating the pump(s).

1.21 Information to be Obtained from the Manufacturer

A. The Contractor shall obtain all items named in these specifications or so noted on the drawings from the equipment manufacturer and such incidental items as may be required for the safe and proper operation of the equipment for the purpose(s) intended.

B. Shop drawings will not be approved until all materials are listed along with the names and catalog numbers of any units being furnished by separate manufacturers.

C. Equipment offered contrary to the provision of this paragraph will be subject to rejection.

1.22 Testing

A. All testing, and retesting if required, of equipment included in this division of the specifications, including any and all superintendence, labor, power, fuel, water, special devices and/or testing equipment required shall be performed by the Contractor at no additional expense to the Owner.

B. A factory-certified test shall be performed on each pump, when indicated in accordance with the test requirements of the Hydraulic Institute. The pumps shall be tested with a calibrated dynamometer. The test shall be sufficient to determine capacity, head, power input, efficiency, and water horsepower. A minimum of 6 points shall be taken including the rated condition and the shutoff. Certified performance curves shall be supplied. Each pump shall be subjected to a hydrostatic test and certification of the hydrostatic test shall be provided. The hydrostatic pressure shall, in any case, not be less than 1-1/2 times the shutoff pressure of the pump. Prior tests on similar or identical pumps will not be acceptable.

C. A factory-certified test shall be performed on each blower when indicated in accordance with the latest edition of the ASME Power Test Code. Prior tests on similar or identical blowers will not be acceptable.

D. Where no certified test is required, data from prior tests on identical units shall be submitted. All characteristic curves shall be submitted on minimum 8-1/2-inch by 11-inch charts.

1.23 Shop Painting

A. Unless noted otherwise in the individual sections of this division, all shop ferrous metal preparation and priming and, where appropriate, finish painting of equipment shall be as specified herein.

B. Before exposure to the weather, the structural steel and other ferrous components of the equipment which will not be submerged in sewage shall be sandblasted in accordance with SSPC-SP6, “Commercial Blast Cleaning”, or pickled in accordance with SSPC-SP8, “Pickling”. Structural Steel and other ferrous components which will be submerged in sewage shall be sandblasted to SSPC-SP10, “Near-White Blast Cleaning”, or pickled in accordance with SSPC-SP8.

C. Following cleaning (and if the part has been pickled, while still warm), the surfaces shall be primed as specified in the section of these specifications entitled Painting.

D. Equipment, such as motors, shall be furnished in the manufacturer’s standard, machinery finish with coatings compatible with the field coats.

E. Bearing areas of shafts, chains, etc., which obviously are not to be painted, shall be protected against corrosion by a heavy coating of grease or approved rust-resistant coating. This coating shall be maintained as necessary to prevent corrosion during the period of erection and shall be satisfactory to the Engineer up to the time of conclusion of the final tests.

F. Maintenance of shop coatings and field painting are specified in the section of these specifications entitled Painting.

PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION (NOT APPLICABLE)

END OF SECTION

SECTION 11040

SEAL WATER SYSTEM

PART 1 - GENERAL

1.1 - SCOPE OF WORK

A. The Contractor shall furnish materials, equipment and labor to furnish, install and test the duplex seal water pumping system complete with the close coupled pumps, motors, piping, valves, pressure switches, pressure gauge, solenoid valve, switches, fabricated pump platform, tank and appurtenances as indicated on the drawings and specified herein.

B. Seal water system shall be American Petroleum Institute Plan 32 type.

1.2 - REFERENCE STANDARDS

A. The work in this section is subject to the requirements of applicable portions of the following standards:

1. Hydraulic Institute standards
2. IEEE standards
3. NEMA standards
4. OSHA Rules and Regulations
5. American Petroleum Institute Standard 682

1.3 - CONFLICTING STANDARDS/REQUIREMENTS

A. Where the requirements of the electrical drawings and/or specifications conflict with the requirements of this specification section the requirements of the electrical drawings and/or specifications shall prevail.

1.4 - REFERENCES

A. Section 11211 – Vertical Dry Pit Wastewater Pumps

PART 2 - PRODUCTS

2.1 - SEAL WATER SYSTEM, GENERAL

A. The capacity of the seal water pumps shall be calculated based on 3.33 GPM for each stuffing box to be served with the pressure 25' greater than the design shutoff conditions for the sewage pumps.

B. Contractor shall verify that the gland seal system provided by the Vertical Dry Pit Wastewater Pump manufacturer is compatible with the requirements of this section. Specifically, the seal water flow rate and pressure required by the wastewater pumps shall be confirmed.

2.2 - CONDITIONS OF SERVICE

A. The following conditions of service shall be strictly adhered to:

1. Number of pumps :	2
2. Type of drive (variable or constant):	constant
3. Pump discharge size, minimum:	1-1/2"
4. Pump Suction size, minimum:	2”
5. Design capacity:	10 gpm

6. Design head:	168 feet
7. Rotative speed, maximum:	1750rpm
8. Shut-off head, minimum:	230 feet
9. Driver horsepower, minimum:	3
10. Voltage / Phase / Hz.	460 / 3ph / 60 or per Electrical plans
11. Manufacturer:	Aurora 130-K05, or approved equal

2.3 - PUMP

A. General

1. Single stage, close coupled, regenerative turbine type

B. Materials of Construction

1. Casing - Cast Iron (ASTM A48)
2. Impeller - Bronze (ASTM B62)
3. Shaft - Stainless Steel (AISI 416) (JM Motor shaft)
4. Channel Rings - Bronze (ASTM B62)

C. Casing

1. The casing shall have a side suction inlet and a centerline discharge outlet. Suction connection and discharge connection shall be NPT threaded. Mounting feet shall be integrally cast with the casing.

D. Impeller

1. The impeller shall be of the regenerative turbine or periphery vane type, with the pumping vanes machined on both sides of the impeller to balance hydraulic thrust. The impeller shall be keyed to the shaft, but not locked in place, to allow the impeller to self-balance between the channel rings. Balancing holes shall be machined into the impeller to facilitate this floating action as required.

E. Shaft

1. The shaft shall be turned and polished and have a keyway machined on the inboard extension to accept a coupling half. The shaft shall be common to both the pump and the motor.
2. The outboard extension of the shaft shall be threaded to accept a shaft nut to prevent excessive lateral shaft movement.
3. The pump shaft shall be integral to the electrical motor provided as part of the pump.

F. Channel Rings

1. The channel rings shall have an individual water passageway machined and cleaned of all burrs, trimmings and irregularities. The channel rings shall be pinned to the bearings covers to prevent rotation.

G. Bearings

1. The pump shall be operated from the motor shaft which shall have adequate strength and bearing support for the design of the pump at its maximum operating pressures.

H. Mechanical Seal

1. Shaft sealing shall be accomplished by means of a mechanical seal with a Ni-Resist seat, carbon washer, Buna-N elastomers and stainless steel metal parts.

I. Seal Gland

1. The bearing cover shall be machined to accept the seal cup to assure positive alignment of the seal faces and eliminate the need for a separate seal gland.

J. Coupling

1. Pumps shall be direct coupled to the motors supplied as part of the pumps. Pumps/motors shall be supplied as an integral unit.

2.4 - FABRICATED RESERVOIR TANK AND MOUNTING ASSEMBLIES

A. The mounting assemblies and the reservoir tank shall be completely fabricated Type 316 stainless steel construction with stainless steel fasteners for ease of tank removal for cleaning.

B. The pump mounting platform shall be welded and fabricated from Type 316 stainless steel. Both pump assemblies will be mounted on one common platform.

2.5 - BYPASS AND RELIEF VALVE

A. The pump system shall have bypass piping from the discharge manifold, up through, and into the supply tank equipped with a relief valve for regulating the bypass flow to prevent pump overheating. Furnish a bronze, spring type relief valve. Bypass and relief valve shall be 3/4" and capable of continuous operation and discharge by-pass.

2.6 - MOTOR

A. The motor shall be horizontal and in accordance with the latest NEMA standards and shall have the following characteristics as standard:

1. Enclosure: TEFC
2. Voltage, Phase, Hz.: per paragraph 2.2
3. Speed: per paragraph 2.2
4. Horsepower: per paragraph 2.2

B. Each motor shall have a sufficient horsepower rating to operate the pump at any point on the pump's head-capacity curve without overloading the nameplate horsepower rating of the motor regardless of service factor. The motor shall have a service factor of 1.15. The service factor is reserved for variations in voltage and frequency.

2.7 - SEAL WATER METERING PANEL

A. Backpanel for mounting of flow gauges shall be 11 gauge minimum, type 316 stainless steel, of sufficient size for mounting the adjustable flow meters and associated pipe and valves.

B. Adjustable Flow Meter

1. Provide one (1) direct-reading precision, adjustable flow meter for each wastewater pump.
2. Meter body shall be single-piece, injection molded polycarbonate plastic around a precision tapered pin. Body shall be mounted to a stainless steel backbone with welded threaded inserts to absorb any piping torque.
3. Meter scale shall be 10” minimum length, epoxy coated brushed aluminum with graduations on both sides of the indicating tube.
4. Provide internal, integral flow guides to stabilize the float throughout the flow range.

5. Meter range shall be 0.8 – 7.0 gpm. Accuracy shall be +/-2% full scale.
6. Metering valve shall be stainless steel.
7. Meters shall be Dwyer “Rate Master” Model RMC-X-SSV flowmeter, or equal.

C. Piping and Valves

1. Inlet water piping to the Metering Panel shall be 1” type 316 stainless steel.
2. Inlet piping shall be equipped with a 1” Y-strainer and a master manual shutoff ball valve, type 316 stainless steel.
3. Inlet branch piping to each flowmeter shall be 1” type 316 stainless steel with 1” type 316 stainless steel ball valve.
4. Outlet piping from each flowmeter shall be ½” type 316 stainless steel. Provide a ½” type 316 stainless steel ball valve between the flowmeter outlet and the downstream stainless steel solenoid valve.

D. Panel Inlet Filter

1. Body/Cap
    a. Clear Lexan body, polypropylene cap, Buna-N O-ring seal between body and cap, 100 psi min pressure rating
    b. Capability to accept 10” long cartridge filter
    c. 1” diameter Inlet x 1” diameter Outlet with pressure relief on inlet.
    d. Pentek 1” #10 “Big Clear w/PR”, Part #166219
2. Cartridge Filter
    a. Nominal 4.5” diameter x 10” long, pleated cellulose media
    b. 20-micron mesh
    c. Max 1.2 psi pressure loss @ 10 gpm
    d. Pentek Model S1-BB, 4.50” x 9.75” 20 micron, Part # 155405-43
3. Accessories/Spare Parts
    a. Provide stainless steel bracket for wall mounting of filter body to wall. Pentek Model # 357640 – WB-SS, stainless steel bracket
    b. Replacement O-ring seal: Pentek 150237, 2 required
    c. Spanner wrench for housing removal: Pentek 144880 Spanner wrench
    d. Filter cartridge: Pentek Model S1-BB, 4.50”x9.75”, 20 micron, Part # 155405-43, 6 required.

E. Mounting

1. Mount the metering panel at the front of the skid on non-metallic Unistrut supports (minimum 2 supports). Bottom of backplate shall be 4’-6” above finished floor.
2. Mount the filter to the wall in close proximity to the metering panel.

2.8 - STRUCTURAL CONFIGURATION

A. A 14 gauge stainless steel tank measuring 20" x 20" x 24". This tank will have an internal capacity of 40 gallons (working volume) of water shall be provided as an integral part of the

seal water system and shall be mounted above the pump system in such a way as to provide a flooded suction for the seal water system pumps.

B. The tank shall be fitted with a C.P.V.C. liquid level indicator mounted on the left side of the reservoir tank.

C. Provide a 3/4" bronze "Y" strainer on the inlet water line before the solenoid valve.

D. An air break installed 6 inches above the top of the tank is required. The seal water system shall be provided with an ASCO "RED HAT" Series II, Model 8210 stainless steel, 1-inch two-way, slow-closing solenoid valve, 115 VAC, normally closed/energize to open. The inlet solenoid valve shall be installed in the inlet water feed line to the position above the system reservoir tank with a wye strainer.

E. Provide a piggy back mercury float switch to be installed in series with the power to the inlet solenoid valve.

F. The reservoir tank and all pumps shall be isolated components via Type 316 stainless steel pipe unions connecting them to the associated piping systems.

G. Provide all Type 316 stainless steel piping, valves and fittings throughout the piping system.

H. Provide a fully adjustable pressure switch set at 30 psi or system pressure failure alarm connection.

I. Provide a stainless steel liquid filled pressure gauge, 0 - 100 psi, in the by-pass manifold for ease of relief valve adjustments.

2.9 - SYSTEM OPERATION

A. As a sewage pump is required, the seal water pump shall be selected automatically by the control panel.

B. Seal water will automatically fill and refill the supply tank via the mercury float switch which signals the solenoid valve to open and close accordingly.

C. Water flow through the seal water pumps shall be assured via the bypass relief valve. This valve shall open upon reaching an adjustable set pressure which shall return and recirculate all water produced at pressure, over and above the required flows and set point pressures.

D. System water shall be delivered to each respective pump's stuffing box as shown on the drawings.

2.10 - APPURTENANCES

A. Water supply and seal water pressure piping shall be type 316 stainless steel.

B. Seal water suction, drain and overflow piping shall be type 316 stainless steel.

C. Check valves, gate valves and strainers shall be type 316 stainless steel.

2.11 - SYSTEM CONTROLS

A. Located in the pump control control panel, all system controls shall consist of individual pump disconnects hand-off-automatic (H.O.A.) switches, pump alternators, . The pressure switch provided at the pump and tank shall signal failure of the system in the event of a problem.

B. Pump control panel shall be NEMA 4X, fiberglass, with clear front panel. Back panel shall be white, enameled carbon steel. Inner door shall be 0.080 black engraved aluminum w/continuous hinge and twist latch. Provide individual pump safe off switches, reservoir low level alarm light, seal water system low level alarm light.

C. Individual pump disconnects shall be provided in the control panel.

D. Seal water storage tank float switches shall be mechanically-activated, narrow-angle float switch, normally closed type. Float shall be polypropylene housing, 1.5” control differential above or below horizontal. Contact shall be rated 5 amps @ 120 VAC, 60 hz. Cable shall be 18-gauge, 2 conductor, water resistant, continuous from the float to the control panel. Float shall be SJE “Signalmaster” Part #1006056 control switch, or equal.

PART 3 - EXECUTION

3.1 - INSTALLATION

A. The Contractor shall insure that the seal water system is properly installed with no pipe strain transmitted to the pump casing.

END OF SECTION

SECTION 11211

VERTICAL DRY PIT SOLIDS-HANDLING PUMP

PART 1 - GENERAL

1.1 - SUMMARY

A. This specification covers vertical, single stage, end suction, centrifugal pumps specifically for municipal, institutional, commercial, and industrial sewage applications. Pumps will be FLYGT as manufactured by Xylem Water Solutions with a maximum 10” diameter suction and 10” diameter discharge.

1.2 - APPLICATION

A. These pump(s) are replacements for the existing Allis-Chalmers pumps currently in service at the pumping station.

B. Pumps provided MUST be capable of being installed into the existing facility with no realignment/replacement of existing suction and discharge piping and valves, with the exceptions of modifying concrete pump base dimensions, adding flange fillers and/or ductile iron spool pieces as required. Pumps which require permanent piping realignment will not be accepted.

1.3 - QUALITY ASSURANCE

A. All pumping equipment furnished under this Section shall be of a design and manufacture that has been used in similar applications, and it shall be demonstrated to the satisfaction of the Owner that the quality is equal to equipment made by that manufacturer specifically named herein.

B. Unit responsibility. Pump(s), complete with motor, base, coupling, necessary guards and all other specified accessories and appurtenances shall be furnished by the pump manufacturer to insure compatibility and integrity of the individual components, and provide the specified warranty for all components.

C. The vertical dry-pit solids-handling pump(s) specified in this section shall be furnished by and be the product of one manufacturer.

D. Pumps are to be engineered and manufactured under a written Quality Assurance program. The Quality Assurance program is to be in effect for at least ten years, to include a written record of periodic internal and external audits to confirm compliance with such program.

E. Pump(s) shall be manufactured under the certification of ISO-9001:2000.

1.4 - REFERENCES

A. Section 11040 – Seal Water System

1.5 - PERFORMANCE

A. The pump(s) shall be designed for and operated continuously under normal service.

1.6 - PUMP CHARACTERISTICS

TABLE "A"

PUMP CHARACTERISTICS

ITEM/DESIGN CONDITIONS	Wastewater Pumps
Maximum Motor Full Load Speed (RPM)	880
Pump Design Speed (RPM)	Variable
Suction Size, Minimum (Inches)	10
Discharge Size, Minimum (Inches)	10
Minimum Pump Shut-off Head (Feet)	112
Maximum Horsepower (HP)	100
NPSHR at Design Capacity (feet)	10

1.7 - OPERATION CRITERIA:

	Flow (GPM)	TDH (ft.)	Max. Pump Speed (RPM)	Max. Solids Passage	Min. Shutoff Head (ft.)	Min. Efficiency @ Design Point
Design Condition	2950	77	880	6"	112	77%
Secondary Condition	5800	40	--	--	--	--

A. Pumped liquid is raw wastewater with a maximum temperature of 85 deg. F.

B. NPSH available at the centerline of the pump impeller is 14' at 4000 gpm.

PART 2 - PRODUCTS

2.1 - PUMPS

A. Manufacturers

1. Basis of design: Xylem Water Solutions.
2. Manufacturer shall have installations of like or similar application with a minimum of 40 years service for this pump size.
3. If Contractor elects to provide a JEA-approved alternate pump, any changes and costs associated with accommodating the alternate pump are the sole responsibility of the Contractor.

B. Design

1. Rotation
   a. The pump will be clockwise rotation when looking at the pump from the drive end. MANUFACTURER SHALL VERIFY ROTATION PRIOR TO SUBMITTING SHOP DRAWINGS.
2. Impeller
   a. The impeller shall be single-suction enclosed type with two vanes, made of Ductile Iron. Impeller be specifically designed with smooth water passages to prevent clogging by stringy or

fibrous materials, and shall be capable of passing solids having a maximum sphere size per paragraph 0 above.

b. The impeller is to be dynamically balanced and shall be keyed and secured to the shaft by a 18-8 stainless steel nut locked in place. It shall be readily removed without the use of special tools.

c. Impeller shall be manufactured by Xylem Water Solutions.

3. Wear Rings

a. Wear rings shall be provided on both the impeller so that clearances can be maintained throughout the life of the rings and minimize recirculation.

b. Impeller wear rings shall be replaceable 11.5-14% chrome steel “L” shaped axial or face-type and mounted on impeller to provide a renewable surface opposite the suction cover wear plate.

c. Wear rings shall be attached to the impeller using an interference fit and Loctite.

d. Wear ring clearance adjustment shall be have provisions for adjustment of axial clearance. This adjustment shall be made through the use of shims placed between the frame and outboard bearing housing.

e. Wear ring shall be manufactured by Xylem Water Solutions.

4. Stuffing Box Cover

a. Stuffing box cover shall be made of ASTM A48 Class 30 close-grained cast iron with integral stuffing box and shall be designed to accept either packing or mechanical seal

b. Mechanical Seal: A John Crane type 21 double mechanical seal or equal shall be installed in the stuffing box.

c. Notwithstanding the above, pump manufacturer shall verify the adequacy of the sealing system proposed to perform adequately with the Seal Water System referenced above.

5. Bearing Frame Assembly

a. The Bearing housing shall be one-piece rigid cast iron construction. Frame shall be provided with cast iron bearing housing at the outboard end, and a cast iron end cover at the inboard end. Both ends of the frame shall be provided with lip type grease seals and labyrinth type deflectors to prevent the entrance of contaminants.

b. Bearing frame shall be designed so that complete rotating assembly can be removed from the casing without disconnecting suction or discharge piping.

c. Frame shall be provided with a ¾ inch IPS pipe tapped hole, located as low as possible to drain the leakage from the packing gland.

d. Jacking bolts for external impeller adjustments are required.

e. Zerk-type grease fittings for bearing lubrication shall be supplied at the bearing housing.

f. The pump shaft shall be high-strength carbon steel, AISI #1045 minimum, accurately machined, tapered at the impeller end and sufficiently sized to transmit full driver output. It shall be protected from the pumped liquid by a shaft sleeve in the stuffing box area. A seal shall be provided, by a synthetic rubber "O" ring, between the shaft and shaft sleeve to prevent leakage of pumped liquid out and/or air into the pump.

g. Shaft sleeve for Mechanical seal: a renewable shaft sleeve used for mechanical seals shall be 300 series stainless steel. positive adhesive sealed to prevent leakage between the shaft and the sleeve, shall protect the shaft through the sealing box area. The sleeve provided shall extend through the stuffing box and under the gland.

h. Inboard bearing – inboard bearings shall be single row, radial type suitable for all loads encountered in the service conditions.

i. Outboard bearing – outboard bearings shall be axial thrust, angular contact, double row ball suitable for thrust loads in two directions.

j. Bearings shall be designed for an L10 life of 100,000 hours per AFBMA at best efficiency point.

k. Bearing Lubrication: bearings shall be grease lubricated with provisions for the addition and relief of grease.

l. Bearing Locking: the outboard bearing shall be locked to the shaft with a nut and lock washer. The lock washer shall have a key seat tab on its ID to prevent it from turning and a set of tabs on its OD, one of which will align with a notch in the nut to prevent it from loosening.

m. Bearing frame, bearing housing and shaft be manufactured by Xylem Water Solutions.

6. Fits and Hardware

a. The volute/casing, suction cover, stuffing box cover, and frame shall be manufactured with concentric shoulder fits to assure accurate alignment. All machined bolts, nuts, and capscrews shall be of the hex-head type and will not require the use of any special tools.

7. Paint

a. Shop Surface Preparation: Prior to paint, blast and clean per SSPC-SP10

b. Shop Primer: one coat of ICI Devoe Bar-Rust 233H for a DFT or 4-6 mils.

c. Field Surface Preparation: Per Section 09900.

d. Field Top Coat(s): Per Section 09900.

e. Color: to be selected by Owner

f. 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 test.

PART 3 - EXECUTION

3.1 - INSTALLATION

A. Installation shall be in strict accordance with the manufacturer's instructions and recommendations in the locations shown on the drawings. Installations shall include furnishing the required oil and grease for initial operation. The grades of oil and grease shall be in accordance with the manufacturer's recommendations. Anchor bolts shall be set in accordance with the manufacturer's recommendations.

B. Pressure and vacuum gauges shall be installed on the discharge and suction sides of each pump.

3.2 - TESTING

A. Motors and Controls

1. The Contractor shall megger each motor winding before energizing the motor and, if insulation resistance is found to be low, shall notify the Engineer and shall not energize the motor.

2. The Contractor shall check all motors for correct clearances and alignment and for correct lubrication in accordance with manufacturer's instructions. The Contractor shall check direction of rotation of all motors and reverse connections, if necessary.

3. All panel controls shall be shown to be operating as intended.

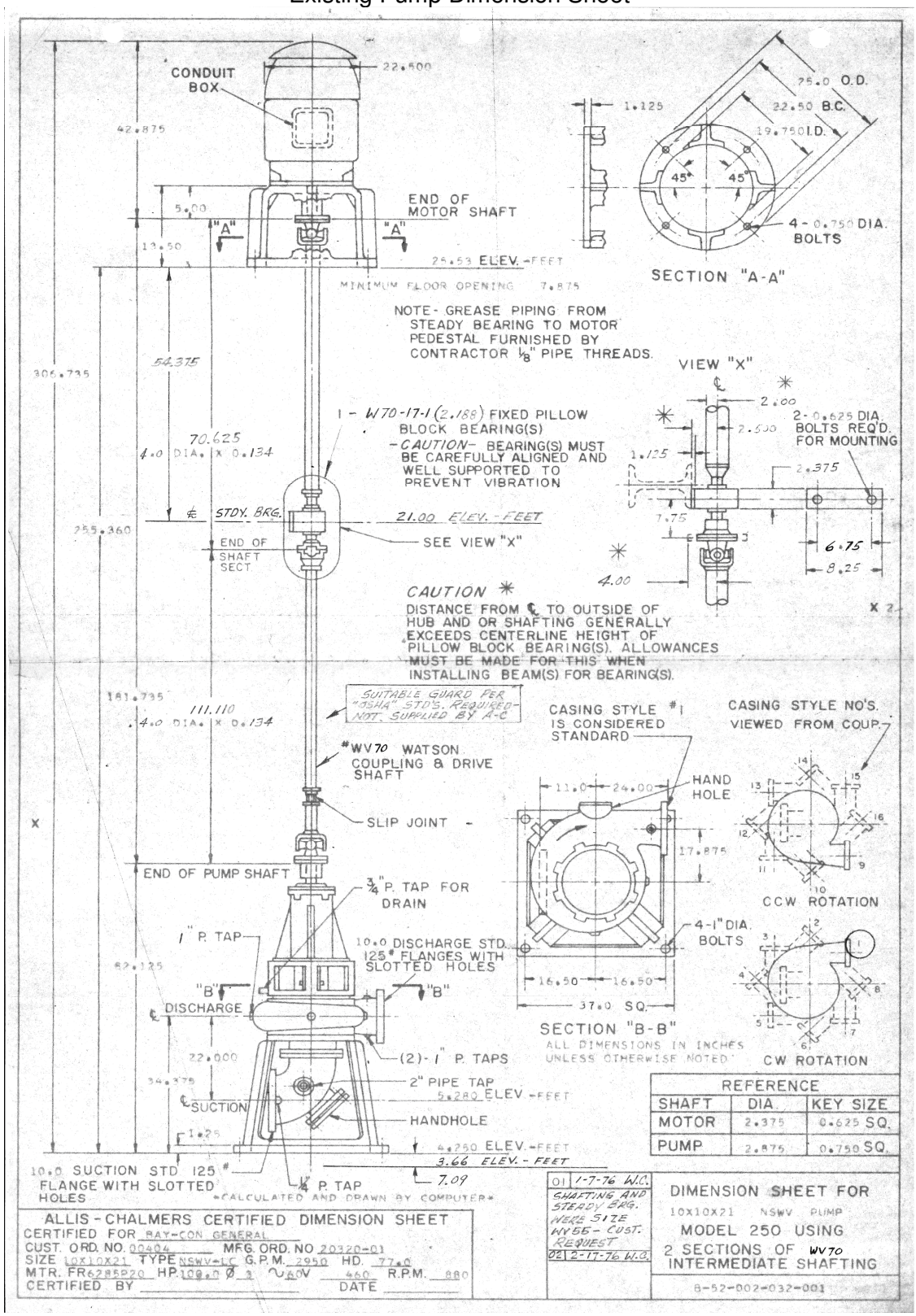
3.3 - MANUFACTURER'S INSPECTION AND FIELD TESTING

A. The equipment manufacturer shall furnish the services of a competent and experienced representative who has complete knowledge of proper operation and maintenance of the equipment for a period of not less than three (3) days to inspect the installed equipment, provide start-up service, supervise the initial test run, and instruct the Owner's personnel.

B. Provide services of an independent balancing and alignment service company who can perform computerized balance analysis and provide a certified computerized report for the vibration signature of the rotating mechanical equipment. Each pump must, as a minimum, meet the Hydraulics Institute standard for smooth running pump equipment for acceptance by the Engineer.

C. Units failing to meet the referenced standard specified shall be repaired or replaced by the Contractor until the equipment is acceptable by this standard, to the Engineer.

D. Field testing shall be witnessed by the Owner and Engineer, and shall be performed after providing the Engineer a 48-hour notification that the field testing is scheduled.



REFERENCE		
SHAFT	DIA.	KEY SIZE
MOTOR	2.375	0.625 SQ.
PUMP	2.875	0.750 SQ.

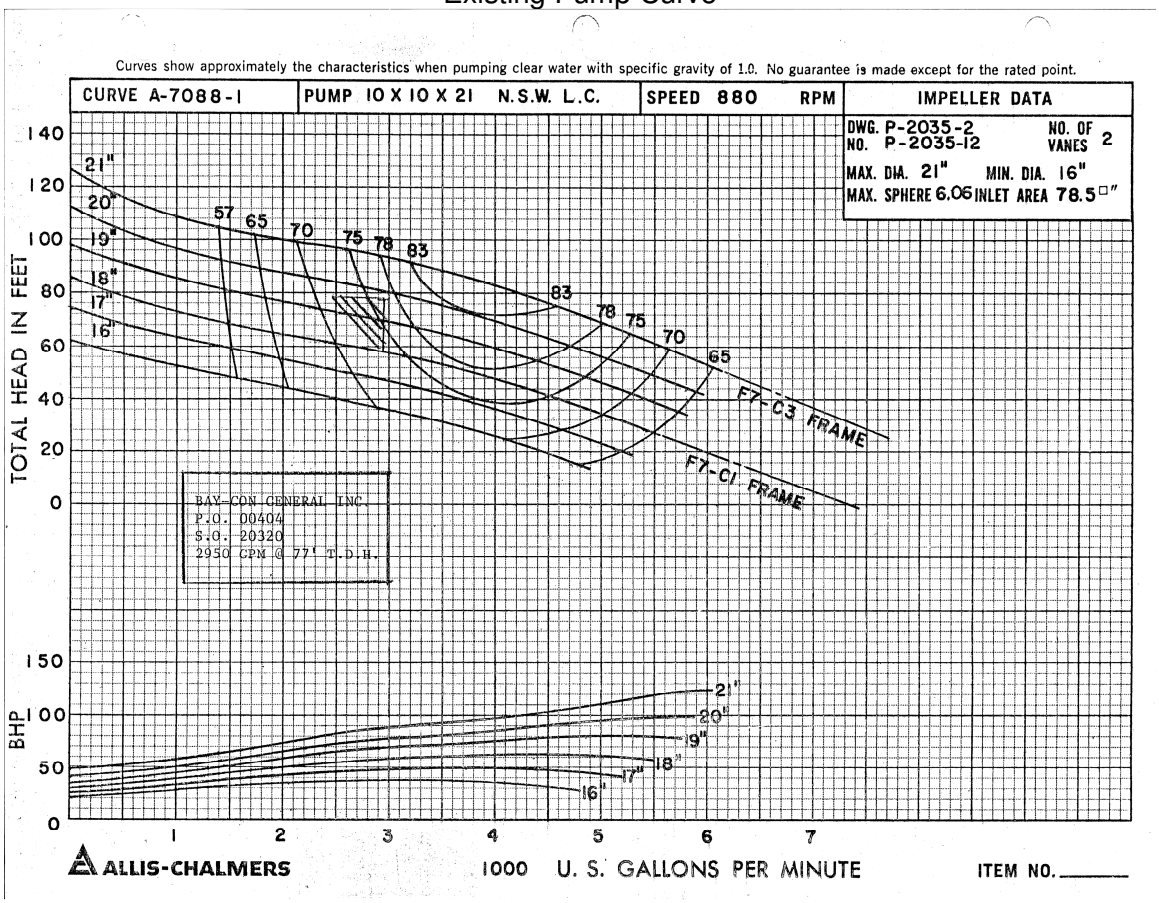
ALLIS-CHALMERS CERTIFIED DIMENSION SHEET
CERTIFIED FOR RAY-CON GENERAL
CUST. ORD. NO. 00404 MFG. ORD. NO 20320-01
SIZE 10X10X21 TYPE NSWV-LC G.P.M. 2950 HD. 77.0
MTR. FR6286P20 HP. 100.0 Ø 3 ~60V 460 R.P.M. 880
CERTIFIED BY _____ DATE _____

01 1-7-76 W.C. SHAFTING AND STEADY BRG. WERE SIZE WY55 - CUST. REQUEST
02 2-17-76 W.C.

DIMENSION SHEET FOR
10X10X21 NSWV PUMP
MODEL 250 USING
2 SECTIONS OF WV70
INTERMEDIATE SHAFTING

8-52-002-032-001

Existing Pump Curve



End of Section

DIVISION 12

FURNISHINGS

NOT USED

DIVISION 13

SPECIAL CONSTRUCTION

BIOTRICKLING FILTER SYSTEM SPECIFICATION
LOCATION AND SIZING INFORMATION

PURPOSE: It is the intent of JEA (Jacksonville, FL) to purchase a complete biological odor control system to be utilized by JEA for Odor Control at:

Date:	
Location Name:	4511 Spring Park Road Pumping Station
Address:	4511 Spring Park Road, Jacksonville, FL 32207

DESIGN BASIS AND SYSTEM SIZING: The complete biotrickling filter odor control system shall be sized for the following characteristics:

Parameter	Units	Min	Max	Avg	Comments
Air Flow	cfm	--	--	1500	
H_2S Inlet	ppm	--	--	600	
H_2S Removal	%	*99*	*>99*	*≥99*	*Min 99% removal / 24 hour average or less than 0.1 ppm, whichever is greater*
Min EBRT @ Max Air Flow	sec	*20*	--	--	*Empty Bed Residence Time*

Other specific design requirements or constraints related to this project are:

Item	Comments
Number of Vessels	*One (1) biotrickling filter vessel system*
Material of Construction	*Fiberglass Reinforced Plastic (FRP) Biotrickling Filter*
Diameter	*N/A*
Height	*N/A*
Vessel Color	*N/A*
Water Supply	*(X) potable or ( ) reclaimed water*

Carbon polishing unit, if required: NOT REQUIRED

Item	Comments
Number of Vessels	*One (1) if required*
Carbon Polisher	*( ) separate unit from BTF vessel or ( ) integral part of BTF*
Material of Construction	*Same as biotrickling filter*
Diameter	*Equal or smaller than biotrickling filter*
Superficial Velocity	*45-55 fpm*
Residence Time	*≥5 seconds*
Media Type/Blend	*( )% Type 1, ( )% Type 2, ( )% Type 3 – see Section 2.6 Part I*

QUOTES: Quotes are due to JEA within ten (10) calendar days of issuance unless otherwise noted. At a minimum, all manufactures shall quote unit prices, F.O.B. destination, and information for the purchase and delivery of the complete odor control system to designated JEA location. Manufacturers must include system details with the quote, including but not limited to vessel material of construction, media type, general dimensions including media volume, and warranty information. Any deviations from this specification shall be fully identified and described in the quote.

RESERVED RIGHTS: JEA reserves the right to accept or reject any and/or all quotes, to waive irregularities and technicalities, and to request resubmission of quotes. JEA also reserves the right to accept all or any part of the quote and to increase or decrease quantities to meet additional or reduced requirements of JEA.

WARRANTY: The complete biological odor control system and all components shall carry a 3-year "Full Replacement Warranty" that shall begin once the unit has been started and is meeting all performance requirements. The synthetic/inert biological media and support grating shall carry a 10-year **non** pro-rated full replacement warranty. Cost of removal and replacement of media shall be by JEA.

PART 1 - GENERAL

1.1 SCOPE

A. The work specified shall include furnishing all labor, design, materials, equipment, incidentals and testing of all equipment and materials necessary to provide JEA with a completely operational Odor Control System for removal of hydrogen sulfide (H_2S) and volatile organic compounds (VOCs) from odorous air within the wastewater collection system.

B. The Biotrickling Filter Odor Control System shall consist of a biotrickling filter vessel, internal structural members, media with support grating, mist eliminator, internal piping, liquid distributors, nutrient feed and storage system, irrigation valves, recirculation pump and piping, air exhaust, fan/blower, process control system control panel, ducting, and any other equipment or accessories required to provide a complete and functioning biotrickling filter odor control system. All major system components, vessel, blower and duct shall be from the same manufacturer for single source responsibility.

C. If specified by JEA, the odor control system shall also include an carbon polisher with carbon polishing media. See Part 2.6 (Carbon Polisher) for additional information.

D. All materials, products, or devices shall be new and unused, unless indicated otherwise in proposal.

1.2 PROCESS DESCRIPTION

A. The system shall perform in accordance with the design basis. It shall be designed for continuous operation in a highly corrosive environment.

B. The biotrickling filter odor control system shall utilize a high surface synthetic/inert media to provide an optimal site for growth of microorganisms (aka: biomass). This media has a high surface/high void area for optimal treatment in a small footprint. Microorganisms that attach to the media are capable of removing H_2S and other odorous VOC's when they are contacted by these compounds in the odorous air stream. A blower conveys the odorous air from the odor source to the media at the bottom of the vessel where the air passes upward through the vessel and media. As the odorous air travels upward it comes in contact with the biomass where non-pathogenic sulfur oxidizing bacteria immobilized on the synthetic media remove H_2S and other odorous VOCs. The biotrickling filter odor control systems counter-current flow of air and water/nutrients enhances the mass transfer to the media where the biological sulfur reduction takes place degrading the odorous compounds to sulfuric acid and other soluble sulfates which are removed in the drain water. If needed, solution containing water and nutrients is conveyed from the sump onto the media via a recycle pump to maintain a healthy biological population. Neutralizing or

oxidizing chemicals shall not be utilized to accomplish odor control within the biotrickling filter. If a supplemental nutrient formula is needed for the odor control system to meet the design criteria, the manufacturer shall provide a reservoir and associated dosing system.

1.3 APPROVED MANUFACTURERS

A. The biotrickling filter manufacturer shall be experienced in the design, construction and successful operation of biotrickling filter odor control systems for the removal of hydrogen sulfide gas and other odor producing compounds from air ventilated from wastewater treatment systems. All equipment shall be furnished by a single manufacturer with single-source responsibility.

B. Systems utilizing organic, lava rock, or stone media shall not be accepted.

C. Below are the approved biological odor control system design and manufacturers for this project:

1	BioAir Solutions, LLC, Voorhees, New Jersey.
2	Evoqua Water Technologies LLC, San Diego, California.
3	Heyward Florida Incorporated, Winter Park, Florida.
4	ECS Environmental Solutions, Belton, Texas
5	Daniel Company, Upland, California

D. If a biotrickling filter manufacturer is not a pre-approved manufacturer and would like to be included in the above list, at a minimum the manufacturer shall:

1. Provide manufacturer literature on biotrickling filter equipment, components and materials. A specification on the material and structural integrity of the vessel must be provided.

2. Provide a letter documenting compliance with this specification, and if necessary, state any exceptions.

3. Provide at least five (5) examples of satisfactory installations treating an average influent hydrogen sulfide concentration of greater than 600 ppm and a peak concentration greater than >1,000 ppm.

4. Provide design criteria for each of the examples, including but not limited to: air flow (cfm), hydrogen sulfide inlet design concentration (ppm), hydrogen sulfide removal (%), water usage (gpd), vessel diameter and height (feet).

5. Provide a list of references for each of the example installations with contact information including but not limited to: accurate contact information of owner (name, job title, location, phone number, email address), placed in service date, design conditions including air flow rate and hydrogen sulfide loading.

6. JEA reserves the right to request additional information.

1.4 SUBMITTALS FOR APPARENT LOW BIDDER

A. Upon notice from JEA, shop drawings and literature describing the equipment shall be submitted to JEA for evaluation and approval. Fabrication of odor control system shall not begin until JEA has given written approval and notice to proceed. If the selected manufacturer's equipment layout, configuration, and/or piping requires changes from the bid documents, it is the responsibility of the manufacturer to clearly submit all proposed changes in the submittals at no additional cost to JEA.

B. The following items may be requested by JEA prior to approval to proceed:

1. Submittals shall include details of construction, materials of construction, model numbers, dimensions, manway locations, media material, media total depth, number of media sections, depth of media per section, vessel exterior color selection charts (if applicable), nutrient storage and feed system, recirculation pump, carbon polisher (if specified), shipping and operating weights, operating parameters, blower performance curves, blower motor (manufacturer, model, bearing type, horsepower, weight, load, efficiency, current and dimensions), process and instrumentation diagrams (wiring and interconnection diagram), electrical schematics, system layout drawings/schematics, recommended methods for handling (unloading, storing, lifting, etc.), mounting and installation instructions, and any other pertinent information that may be required for a successful odor controls system.

2. Manufacturer shall submit description of the laminate and the type of reinforcing to be used and a letter from the manufacturer stating the laminate reinforcing material used will provide chemical resistance at least equal to the published chemical resistance for the resin for the intended application, and the resin will meet the performance requirements stated and is suitable for the service conditions specified herein and the fabrication technique proposed. Manufacturer shall also submit certification of applicable wind load design in accordance with current edition of the Florida Building Code.

3. Manufacturer shall furnish a list of recommended spare parts for each piece of equipment in the scope of supply.

4. Manufacturer shall submit calculations indicating the basis of design for the system. These must demonstrate that the equipment is structurally sound and that the system will perform as specified. Manufacturer shall submit complete design calculations for the media support system. The design calculations shall be sealed by a Registered Professional Engineer in the State of Florida.

C. Manufacturer is required to submit the following items.

1. Submit certification indicating the quality control, testing, and inspection has been completed and standards specified herein have been met prior to shipment to the jobsite.

2. Manufacturer shall furnish two (2) bound copies and an electronic copy of the Operation and Maintenance instructions. The information shall be sufficient to instruct personnel who are unfamiliar with such equipment in the operation and maintenance of the system. It shall include diagnostic procedures to be used in the event of system shutdown or malfunction.

3. Submit the performance guarantee and warranty for the system.

4. Submit results of all performance testing procedures and results.

D. Upon notice from JEA, requested submittals must be submitted within twenty (20) calendar days. All exceptions and/or deviations shall be fully identified and described.

PART 2 - PRODUCTS

2.1 GENERAL

A. The biotrickling filter shall be cylindrically shaped with upflow air passage and countercurrent liquid flow. The biotrickling filter shall include an engineered baffle to ensure 0% bypass of the air stream around any of the media bed.

B. The system shall include the equipment and controls necessary to automatically and effectively remove contaminant gases and to minimize the possibility of breakthrough due to fluctuations in gas flow or concentration.

C. The system shall be able to operate in a constant liquid recirculation mode, intermittent freshwater mode, and the ability to do both.

D. All parts for the odor control system shall be installed in strict accordance with the manufacturer's instructions and under the guidance of the manufacturer's field representative. All components shall be designed for operation in a highly corrosive environment. All exposed parts shall be suitable for direct sunlight.

E. All materials of construction including miscellaneous hardware shall be resistant to attack by the corrosive compounds present in the air stream, as well as those present in the recirculating liquid, including biodegradation by-products. Nuts,

bolts, and washers shall be 316 stainless steel.

F. All special tools required for normal operation and maintenance of the equipment shall be furnished with the equipment by the manufacturer. The Operation and Maintenance Manual shall identify each such tool and where it is used.

G. Manufacturer is responsible for the duct from the blower to the biotrickling filter vessel, and, if applicable, from the biotrickling filter vessel to the carbon polishing system. Duct shall include required transition pieces, valves and expansion joints to connect to fan outlet and odor control equipment. Ducts shall be of sufficient diameter and designed to move air without undue pressure loss. The pressure loss of the combined odor control system and duct work shall not exceed the maximum pressure available from the blower at the specified air flow rate operating at non-overload conditions.

H. Products shall comply with National Fire Protection Association 820: Standard for Fire Protection in Wastewater Treatment and Collection Facilities.

2.2 PERFORMANCE REQUIREMENTS

In addition to the system requirements identified on the Location and Sizing Information page for the specific project the biotrickling filter system shall be designed for the following operating conditions and criteria. **Systems not meeting minimum EBRT (Empty Bed Residence Time) will not be accepted.**

Minimum H_2S Removal Efficiency / 24 hr Avg.	**>99% or less than 0.1 ppm, whichever is greater**
Max. Pressure Loss Across Vessel (Biological only)	**<3.0" water column**
Max. Pressure Loss Across Vessel (Biological and Carbon)	**<6.0" water column**

2.3 BIOTRICKLING FILTER VESSEL, MEDIA, AND COMPONENTS

A. The entire biotrickling filter vessel shall be made of fiberglass reinforced plastic (FRP) material. The FRP shall be premium vinyl ester fiberglass resin. Vessels shall be resistant to chemical attack compounds present in the application. Vessels shall also be UV resistant.

B. Vessel components shall be preassembled at the point of fabrication. Preassembly will not require all joints to be factory assembled, but all joints shall be prepared for field fabrication and square.

C. JEA reserves the right to select the biotrickling filter vessel exterior color (if applicable). If not specified, the manufacturer shall supply their standard

equipment color (white, grey or black).

D. At a minimum, four (4) manways (sump, top, and bottom of packing, and top of mist eliminator) shall be provided. Manways at the top and bottom of the packing shall be at least 24″ in diameter for access to facilitate both removal and replacement of the media. They should be located away from any obstructions such as piping and ductwork. If the vessel is 6-foot in diameter or smaller, the 24″ manways are not required as long as adequate access to the media is provided for removal and replacement.

E. The bottom or reservoir section shall include air inlet connection, makeup water connection, nutrient feed connection (if needed), inoculant injection connection, recirculation pump suction connection (if needed), drain, and overflow. The drain shall be positioned as close to the bottom as possible so the reservoir section can drain completely.

F. Equipment shall be furnished with concrete anchors and hold down lugs, complete with 316 stainless steel plates, bolts, nuts and washers for proper anchoring of the tank as required by the manufacturer.

G. The structure shall comply with the current edition of the Florida Building Code including design for applicable wind loads. If necessary, hurricane straps and accessories shall be provided to securely anchor the unit to the slab.

H. Biotrickling filter shall have air inlet and outlet flanges. Flanges shall be 3/8″ thick and widths will be commensurate with the scrubber dimensions. Maximum flange width will be 3″.

I. Air inlet duct between the blower and vessel shall have a 1″ diameter tap and 1″ ball valve for inlet air sampling. Also provide a 1″ diameter tap and 1″ PVC ball valve in the bottom of the duct to remove condensate in air duct at low elevations including before the blower and between the blower and vessel (if applicable). If a separate carbon polishing unit is provided a 1″ diameter tap and 1″ ball valve for inlet air sampling and 1″ diameter tap and 1″ PVC ball valve for condensate shall be provided on the transition duct.

J. Vessel shall be furnished with a vertical exhaust stack with a bolted flanged connection to the outlet. Vertical exhaust stack shall be provided with a down turned 2″ diameter internal outlet air collection, transitioning to 1″ diameter outside the vessel, routed down to approximately 4′ above the finished grade with a 1″ ball valve for outlet air sampling. Outlet sample shall have either a ½″ hole in the pipe downstream of the sample location to facilitate airflow, or shall be routed to the suction side of the blower to allow for positive flow to the sample location.

K. The chemically resistant synthetic/inert media shall have a high surface area to provide an optimal site for growth of microorganisms while allowing for even airflow and water recirculation without possibility of media compaction. The

media shall be made from chemically resistant material. The system must be constructed in a manner to minimize the potential for short circuiting of the air being treated.

L. Media shall be supported by media support plates, packing support plates and mid span supports. Supports shall be suitable to support the weight of the packing specified plus entrained water/solution and any deposits on the media. Opening size shall not allow for passage of packing media in any random orientation. Manufacturer shall provide instructions for placement and removal of packing support in and out of the vessel.

M. The vessel shall be configured with at least one fluid injection spray nozzle designed to be clog resistant. The spray nozzle shall be located to disburse the fluid evenly over the entire media surface area. Internal spray piping shall have flanged connection for easy removal without entering the vessel.

N. The operation of the spray nozzles shall be via a recirculation pump (recirculation mode) or a motor controlled actuator valve (fresh water intermittent mode) and shall be capable of continuous, intermittent, and dual mode operation with either recirculated sump water or fresh water.

O. Mist eliminator shall be provided to prevent excess mist from being discharged from the tower exhaust. Mist eliminator shall be designed to remove 99% of all mist particles 40 microns and larger and 90% of all mist particles 10 microns and larger.

P. Recirculation pump shall be a magnetic drive pump, dynamically balanced and be capable of mounting directly to standard NEMA motors. The pump shall be totally enclosed and suitable for exposure to the elements. Motors shall be TEFC. Vertically mounted motors shall include rain guard for protection. If necessary, the recycle line shall include motorized ball valves to alternate between multiple spray headers.

Q. Provide either an external or integral nutrient storage tank and feed/recirculation system.

1. To maintain a fresh nutrient supply, nutrient storage tanks shall be sized for a minimum 7-day supply and a maximum of 14-day supply.

2. Nutrients shall be available locally, non-hazardous, and non-proprietary. Manufacturer is responsible for providing chemical composition of recommended nutrients along with non-proprietary supplier information.

3. The nutrient dosing system shall be provided by a dedicated metering pump for the delivery of nutrient to the media bed compartment. The metering pump shall be manually adjusted for output by the operator. Nutrient system tank shall include fill, outlet, low level indicator and vent.

R. Vessel shall be provided with a permanently attached, stainless steel equipment identification plate. The label shall state the following in die-stamped lettering for the plate:

- Equipment identification (tag) number shown on submittals and vessel name.
- Manufacturers name and address.
- Model number and serial number.
- Date of manufacture.
- Material of construction.
- Design pressure (vacuum).
- Vessel dimensions.
- Operating weight.

2.4 CENTRIFUGAL BLOWERS

A. Blowers shall be corrosion resistant cast aluminum, welded aluminum or FRP direct drive.

B. All internal and external blower hardware shall be 316 stainless steel.

C. Motors shall be high-efficiency, 1.15 service factor, 3phase/60hz 208-230/460V. Motors shall be stainless steel washdown/inverter duty induction type motors with sealed, lubricated bearings mounted on a corrosion resistant aluminum or stainless steel motor pedestal. No painted carbon steel bases shall be allowed. Bearings shall be heavy duty, self-aligning grease lubricated ball or roller type with a minimum 100,000 hour B-10 life. OSHA approved shaft guard shall be provided when fan wheel is not direct coupled to the motor. For motor frame sizes larger than 3HP use Severe Duty TEFC Motors.

D. Blower impeller shall be dynamically balanced prior to assembly.

E. Blower motor shall be operated by a variable frequency drive (VFD) motor controller for precise air flow control to the biotrickling filter.

F. Blower inlet/outlet shall be provided with a flex connector. The blower shall be shipped loose from the system and anchored to the concrete pad without the need for vibration isolators.

G. The pressure loss of the combined odor control system and duct work shall not exceed the maximum pressure available from the blower at the specified air flow rate operating at non-overload conditions.

2.5 PROCESS CONTROL SYSTEM PANEL AND ACCESSORIES

A. Process control system panel(s) shall be provided to operate the blower, nutrient

pump, actuator valve, recirculation pump(s), instrumentation and all other system components.

B. The process control system panel(s) shall be manufactured of marine grade aluminum, FRP or stainless steel with all stainless steel mounting hardware where necessary and rated NEMA 4X. The biotrickling filter control panel shall be provided to operate the nutrient feed pump, pressure gauge(s), actuator valve, valves, timer relays, flow meter, recirculation pump, instrumentation and all other system components in a complete packaged system for operation of the odor control system. The control system(s) shall include an Eaton Cutler Hammer SVX9000 VFD blower motor controller. Start/stop control shall be provided for each recycle pump, and hand-off timer control shall be provided for the nutrient pump.

C. Portable pressure gauge(s) shall be provided in lieu of installed gauge(s) and differential pressure indicator as long as connections are provided to allow for measurement.

D. Circuit breaker protection for all motor circuits shall be provided. A main disconnect and control transformer to 120 VAC control power shall be included.

E. Labels shall be fixed to the face of the panel in such a manner that the function of each component shall be easily ascertained. Label terminal strips shall be provided in order to facilitate wiring of external devices such as switches, sensors, meters, and controllers. No more than two conductors shall be located in each termination point.

F. Wiring practices shall meet standards set by the latest editions of the National Electric Code (NEC).

G. All conductors shall be labeled with wire numbers and those numbers shall correspond with those provided in a wiring and panel layout diagram. All components shall be labeled with the same symbol reference shown in the electrical wiring and instrument list.

H. System supplier shall provide any and all necessary start-up or acclimation kits required to place the system into successful operation.

I. Equipment metal frame work shall include a ground wire #2 cu thinned to the grounded grid. It shall be exothermically welded to the grounding grid and mechanically attached to the frame with a compression terminal on the wire and bolted to the frame. Consult JEA standard grounding drawings on jea.com for additional information.

2.6 CARBON POLISHER

A. If specified on the cover sheet, manufacturer shall include a carbon polisher and carbon polishing media. Cover sheet will also specify whether carbon polisher

should be combined into a single unit with the biotrickling filter or a separate unit based on site specific height and footprint limitations. If the biotrickling filter and carbon system are separate units the carbon system materials of construction shall match the biotrickling filter unless otherwise noted. If the biotrickling filter and carbon polishing system are separate units, all transition ducts, supports and other ancillary equipment required to provide a complete system shall be included. Duct shall be provided between the biotrickling filter and carbon system which shall also include isolation dampers and an exhaust port and/or stack to allow the carbon system to be isolated when replacing media.

B. Equipment shall be furnished with concrete anchors and hold down lugs, complete with 316 stainless steel plates, bolts, nuts and washers for proper anchoring of the tank as required by the manufacturer.

C. The structure shall comply with the current edition of the Florida Building Code including design for applicable wind loads. If necessary, hurricane straps and accessories shall be provided to securely anchor the unit to the slab.

D. The exhaust from the carbon polishing vessel shall be equipped with a chimney cap / rain guard to protect the media from getting wet from weather events.

E. The superficial velocity through the carbon unit shall be 45-55 fpm.

F. The residence time through the carbon unit at the specified air flow rate shall be as specified on the site specified page of these specifications.

G. The biologically treated air (99% hydrogen sulfide removed) shall passes through a carbon polisher for final air polishing then discharged to atmosphere. In addition to sample ports provided before and after the biotrickling filter to monitor performance, multiple sample ports shall be provided vertically through the carbon vessel to monitor breakthrough.

H. Manways shall be provided to facilitate both removal and replacement of the carbon media. Manways shall be at least 24-inch in diameter and shall be located away from any obstructions such as piping and ductwork. If the vessel is 6-foot in diameter or smaller, the 24" manways are not required as long as adequate access to the media is provided for removal and replacement.

I. Manufacturer is responsible for providing initial supply of carbon polishing media.

J. Media blend shall be determined by equipment supplier and JEA based on specific odors to be removed. Odors include but are not limited to hydrogen sulfide, sulfur dioxide, mercaptans, and other organic compounds. Media types include:

1. H_2S Specific Media

Mesh Size	4 x 8
Mean Particle Diameter	3.4 mm (avg.)

Moisture	8% (max as packaged)
H2S Breakthrough Capacity	0.20 (min gH_2S/cc carbon)

2. Coconut Shell Media

Mesh Size	4 x 8
CCI4 Activity	60% (min)
Iodine No	1100 (min mg/g)
Hardness	98% (min)
Ash Content	5% (max)
Moisture	5% (max as packaged)

3. Potassium Permanganate Media

Mesh Size	4 x 8
Moisture	12% (avg as packaged)
Potassium Permanganate Content	6% (min)

PART 3 – EXECUTION

3.1 SHIPPING, STORAGE AND HANDLING

A. Equipment shall be inspected for damage prior to unloading. Manufacturer shall be notified immediately upon notice of damage. Any damaged equipment shall be promptly replaced at no cost to JEA.

B. Product delivery, storage, and handling shall comply with Manufacturer's instructions and as follows:

1. All media shall be delivered in bags for ease of install.

2. Long term media storage is not acceptable.

3. All electrical and ancillary equipment shall be stored in a climate controlled building greater than 50 degrees F.

4. All parts shall be properly protected so that no damage or deterioration will occur in transit or during prolonged storage at the site.

5. All openings in equipment shall be protected against entry of foreign objects.

6. Each box, crate, and package shall be properly marked to show its contents and net weight.

C. Equipment shall be shipped on an open flat-bed trailer to facilitate offloading. A covered trailer may be utilized with prior approval providing that equipment is at or near the open end.

3.2 INSTALLATION

A. Installation shall be in strict accordance with the respective manufacturer's instructions and recommendations. Anchor bolts shall be furnished by the equipment supplier and set in accordance with the manufacturer's recommendations.

3.3 MANUFACTURER SERVICES

A. The manufacturer shall provide the services of a qualified service technician who shall adequately supervise the installation and testing of all equipment furnished under this contract and instruct JEA operating personnel in its proper maintenance and operation. The manufacturer shall provide service technician for at least four (4) trips no less than 8 days total for installation assistance, start-up, and post start-up inspection of the equipment. Within the first year of operation a direct employee of the manufacturer (not local representative) shall make quarterly visits after installation to ensure proper operation of the system. Emergency response for first year is 24 hour call back and on-site within 5 business days at no cost to JEA.

B. The biotrickling filter system with other associated equipment such as the blower, piping and controls shall be field-tested.

C. JEA shall furnish water, power and nutrients required for startup and testing.

D. The startup and testing shall meet the performance guarantees described under performance requirements listed herein. All equipment shall show evidence of mechanical soundness, no evidence of liquid or gas leaks, no undue vibration and generally be structurally rigid when being tested.

E. The manufacturer representative witnessing the biotrickling filter system startup and field test shall furnish the Owner a written report certifying that the unit is operating according to specifications.

F. Coordinate startup services with the blower and VFD. The manufacturer representative of the biotrickling filter system shall provide all speed and protection settings necessary for this device.

3.4 PERFORMANCE TEST

A. The manufacturer shall provide for a direct employee (not local representative) to conduct performance testing to ensure hydrogen sulfide removal efficiency.

B. The performance test shall be conducted after sufficient acclimation time and at such time as all anticipated odorous air streams are present in the scrubber inlet.

C. The odor control system shall be tested under actual operating conditions in order to demonstrate that it will perform as required. During the test, air flow rates, recirculation rates and other controllable parameters must remain constant and recorded.

D. The test shall last at least twenty-four (24) consecutive hours and samples shall be

taken from the inlet and outlet of the scrubber system using an OdaLog portable gas detection instrument. Performance testing will also be required on quarterly visits as described above. If the equipment includes a carbon polishing unit the outlet of the system shall also be recorded during performance testing using an OdaLog. It shall be noted that performing testing is based on the biotrickling filter only. The outlet conditions of the carbon polisher shall be tested but will not be included to meet the performance testing requirements specified herein.

E. Should the system performance not meet any of the above requirements, that system shall have failed the performance test. The manufacturer shall make any additions or modifications to the system as may be necessary, at no additional cost to JEA, and the performance tests for that system shall be repeated in its entirety. In the event of three (3) failed performance tests, the system will be rejected and the manufacturer shall remove equipment within 30-days and refund JEA the entire bid price.

F. Manufacturer shall certify the results of the test and submit a written test certification report of the test to JEA. The conditions tested shall be documented and the parameters recorded including air flow rates, recirculation rates and pH. Any additional time required to achieve successful installation and operation shall be at the expense of the manufacturer and not JEA.

G. Each performance test shall be witnessed by JEA and results submitted for review and acceptance.

3.5 WARRANTY

The complete biological odor control system and all components shall carry a 3-year "Full Replacement Warranty" against defects in workmanship and materials that shall begin once the unit has been started and is meeting all performance requirements. Manufacturer shall modify or replace any equipment that fails to perform as specified, at no additional cost to JEA. The synthetic/inert biological media and support grating shall carry a 10-year **non** pro-rated full replacement warranty. Labor cost of removal and replacement of media shall be by JEA.

- END OF SECTION -

DIVISION 14

CONVEYING SYSTEMS

NOT USED

DIVISION 15

EQUIPMENT

SECTION 15010
MECHANICAL BASIC REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes general mechanical requirements for work specified in all other sections of Division 15, the drawings, schedules and by the requirements of this Section.

B. Division 1: Refer to Division 1 sections for general requirements.

1.2 QUALITY ASSURANCE

A. Labels and Listings: Refer to Division 1 for requirements that materials, appliances and equipment provided meet the requirements of the Underwriter's Laboratories, Inc. (UL) and other standards organizations. Lettering size and style shall comply with American National Standards Institute, Inc. (ANSI) A13.1 "Scheme for the Identification of Piping Systems."

B. National Fire Protection Association (NFPA): All work provided under this Contract shall meet the requirements of the NFPA.

C. Current Models: All work shall be as follows.
   1. Manufactured items furnished shall be the current, cataloged product of the manufacturer.
   2. Replacement parts shall be available.

D. Experience: Unless more stringent requirements are specified in other sections of Division 15, manufactured items shall have been installed and used, without modification, renovation or repair, on other projects for not less than one year prior to the date of bidding for this project.

1.3 SUBMITTALS

A. Division 1: Conform to the requirements of Division 1, Section 01300, "Submittals."

B. Submittal List: Items for which submittals are required are included in each section of Division 15.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Delivery: Refer to Division 1 for the requirements of material and products to be delivered to the project site.

B. Storage: Materials stored at the project site which become soiled with construction dirt, concrete or earthwork shall be washed, cleaned and dried to the satisfaction of the Contracting Officer's representative or removed from the project site and replaced with new. Do not install soiled material.

C. Protection: Protect and store material and equipment in such a manner as to effectively prevent damage from climatic conditions.

1.5 LABELS AND NAMEPLATES

A. Division 1: Conform to Division 1 for all work furnished under this Division.

B. Manufacturer's Nameplates: Nameplates on manufactured items shall be aluminum or Type 304 stainless steel sheet, not less than 20 gage, riveted or bolted to the manufactured item, with nameplate data engraved or punched to form a non-erasable record of equipment data.

C. Field Installation: Field-installed nameplates shall be engraved melamine plastic laminate, 1/8 inch thick, engraved in block capital lettering to expose white lettering on black face. Screw or bolt to equipment. Adhesive attachment will not be permitted.

D. Smaller Labels: Labels 20 square inches and less may be 18 gage. Secure labels with rivets, stainless steel bolts, stainless steel strap or supporting angle.

E. Approval: Submit a schedule of nameplates, abbreviations and equipment designations for approval.

F. Lettering Style: Comply with ANSI A13.1 for lettering size and style.

1.6 MAINTENANCE AND OPERATING MANUALS

A. Division 1: Conform to the requirements of Section 1730, "Operation and Maintenance Data" for all manuals and operating information required under Division 15.

B. Field Installed Schedules: Conform to the requirements of Section 1700 and 1720 when furnishing the "Operation and Maintenance Data" for all diagrams, charts, schedules and operating information required under Division 15.

C. Instructions: Conform to the requirements of Section 1730, "Operation and Maintenance Data" for all work furnished under Division 15. Examine each section of Division 15 for instruction, training and operating manual requirements.

1.7 SUBSTITUTIONS

A. Division 1: Conform to the requirements of Section 01600, "Material and Equipment," article "Substitutions. "

1.8 TEMPORARY FACILITIES

A. Division 1: Refer to Section 01500 "Construction Facilities and Temporary Controls" for the requirements of temporary utilities for construction and safety.

1.9 COORDINATION

A. General: Coordinate mechanical work with that of other trades in order to:
   1. Avoid interference’s between general construction, mechanical, electrical, structural and other specialty trades.
   2. Maintain clearances and advise other trades of clearance requirements for operation, repair, removal and testing of mechanical equipment.
   3. Mechanical layouts indicated on drawings are diagrammatical. Exact locations of ducts, pipes and equipment are subject to building and structural conditions.

Where minor adjustments in the work are necessary to avoid conflicts, make these changes without additional cost to the owner.

1.10 SIZING

A. Capacity: Provide equipment and material of sizes, capacities, power input, power ratings and dimensions indicated on the drawings, in the schedules and as specified.

B. Fit and Clearance: All equipment, such as condensing units, heat pumps, air-handling equipment, and filters, shall fit the space shown on the project drawings. Provide access for servicing, repairing and inspecting apparatus at least equal to that shown. Each item of equipment shall be installed without damage to the building, building equipment, or the item itself. Verify building access constraints before delivery of equipment to the project site.

C. Deviations: Equipment and material of greater or larger power, dimensions, capacity and ratings may be furnished, provided such proposed equipment is approved in writing and feeders, circuit breakers, conduit, motors, bases and equipment spaces are increased by the contractor at no cost to the Owner. If minimum energy ratings or efficiencies of the equipment are specified, the equipment must meet the design requirements.

1.11 MANUFACTURER'S RECOMMENDATIONS

A. General: Where installation procedures or any part thereof are required to be in accordance with manufacturer's recommendations, furnish printed copies of the recommendations prior to installation. Installation of the item shall not proceed until recommendations are received. Failure to furnish recommendations shall be cause for rejection of the equipment or material.

1.12 POSTED OPERATING INSTRUCTIONS

A. General: Furnish approved operating instructions for systems and equipment indicated in the technical sections for use by operation personnel. The operating instructions shall include wiring diagrams, control diagrams, and control sequence for each principal system and equipment. Print or engrave operating instructions and frame under glass or in approved laminated plastic. Post instructions where directed. Attach or post operating instructions adjacent to each principal system and equipment including start-up, operating, shutdown, safety precautions and procedure in the event of equipment failure. Provide weather-resistant materials or weatherproof enclosures for operating instructions exposed to the weather. Operating instructions shall not fade when exposed to sunlight and shall be secured to prevent easy removal.

1.13 RENOVATION PROJECTS

A. Demolition: Provide disconnection, demolition and renovation work specified under Division 15 and as indicated and scheduled on the drawings. If control conduit, wiring, pneumatic tubing, etc. is removed from existing equipment but needed to control other equipment, contractor shall provide new control conduit, wiring, pneumatic tubing, etc. as necessary to keep the existing equipment that is to remain in operation.

B. Damage: Where pipe, ductwork, insulation or equipment to remain is inadvertently damaged or disturbed, cut out and remove damaged section and provide new pipe, ductwork, insulation or equipment of equal capacity and quality.

C. Accessible Work: All pipe and ductwork noted to be removed shall be removed in its entirety.

D. Abandoned Work: Buried pipe abandoned in place, shall be cut out approximately 2 inches beyond the face of adjacent construction, capped, and the adjacent surface patched to match existing finish.

E. Removal: Equipment specified or indicated to be demolished, shall be removed from the project site and shall not be reused.

F. Temporary Disconnection: Equipment required to be temporarily disconnected and relocated shall be carefully removed, stored, cleaned, reinstalled, reconnected and made operational.

PART 2 PRODUCTS

2.1 DIVISION 15 SECTIONS

A. General: Conform to the requirements of Division 15 sections for all products furnished under this Contract.

2.2 MANUFACTURERS

A. Fire stopping shall be by 3M, Dow Corning, Hilti-Ciba-Geigy, or Fibrafrax.

B. Pipe hangers shall be by Elcen, Fee and Mason, Grinnell, or Unistrut.

C. Motors shall be by General Electric, Lincoln, Louis Allis, or Reliance.

D. Motor Sentinel Switches shall be Square D Class 2510 or Westinghouse MST Series

E. Combination Starter/Disconnect shall be Square D Class 8500 or Westinghouse A200 Series

F. Motor/Circuit Disconnects shall be Square D Class Type HU or Westinghouse Type HF or HU.

G. Access doors shall be manufactured by the Milcor Division of Inland-Ryerson, or an acceptable equal.

2.3 PIPE HANGERS AND SUPPORTS

A. Plumbing Piping - DWV - Conform to ASTM F708.
1. Hangers for Pipe Sizes 1/2 to 1-1/2 Inch Malleable iron, adjustable swivel, split ring.
2. Hangers for Pipe Sizes 2 Inches and Over: Carbon steel, adjustable, clevis.
3. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
4. Wall Support for Pipe Sizes to 3 Inches: Cast iron hook.
5. Wall Support for Pipe Sizes 4 Inches and Over: Welded steel bracket and wrought steel clamp.
6. Vertical Support: Steel riser clamp.
7. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.

B. Plumbing Piping - Water - Conform to ASTM F708.
   1. Hangers for Pipe Sizes 1/2 to 1-1/2 Inch: Malleable iron, adjustable swivel, split ring.
   2. Hangers for Cold Pipe Sizes 2 Inches and Over: Carbon steel, adjustable, clevis.
   3. Wall Support for Pipe Sizes to 3 Inches: Cast iron hook.
   4. Wall Support for Pipe Sizes 4 Inches and Over: Welded steel bracket and wrought steel clamp.
   5. Vertical Support: Steel riser clamp.
   6. Floor Support for Cold Pipe: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.

2.4 MOTORS

A. Electric motors shall be new NEMA Standard, sized and designed to operate at full load and full speed continuously without causing noise, vibration, and temperature rise in excess of their rating.

B. Motors on belt driven equipment shall have slide rails with adjusting screws for belt tension adjustment. Motors exposed to the weather shall be weather-protected.

C. High efficiency electric motors shall be installed on air handling units, rooftop units, and exhaust fans.

D. High efficiency motors shall have efficiency and losses determined in accordance with the latest revisions of IEEE Standard 112. Polyphase squirrel-cage motors rated 1 through 125 horsepower shall be tested by dynamometer method B. The efficiency will be determined using segregated losses in which stray load loss is obtained from a linear regression analysis to reduce the effect of random errors in the test measurements. Guaranteed minimum load efficiency shall be as follows:

MOTOR HP	FULL LOAD RPM	GUARANTEED MINIMUM FULL LOAD EFF.
3	1750	86.5
5	1750	86.5
7-1/2	1750	88.5
10	1745	88.5
15	1760	90.2

E. Motor sound power levels shall not be greater than recommended in NEMA MG 1-12.49.

F. Provide motors with drive shafts long enough to extend completely through belt sheaves when sheaves are properly aligned or balanced.

G. Motor Characteristics:
   1. 120V/1/60 Hz: Capacitor start, open drip-proof type, ball bearing, rated 40 C. continuous rise.
   2. 208/3/60 Hz: NEMA B, normal starting torque, single speed, squirrel-cage type, open drip-proof, rated 40 C continuous rise, with ball bearings rated for B-10 life of 100,000 hours and fitted with grease fittings and relief ports. Provide motors with aluminum end brackets with steel inserts in bearing cavities.

2.5 ACCESS DOORS

A. Provide as necessary for access to concealed valves, cleanouts, unions, expansion joints, dampers, coils, junction boxes, etc., where no other means of access is shown, specified or available.

B. Each door shall be equipped with two flush, screwdriver operated, cam latches and, other than Style "M", shall be finished to match adjacent surface.

C. Door sizes shall be applicable to the access required for normal service.

D. The type of doors shall be as follows:

Door Location	Door Type
Drywall	Style "DW"
Masonry or tile	Style "M-Stainless"
Plaster	Style "K"
Fire-rated walls	Style "Fire Rated"

PART 3 EXECUTION

3.1 ACCESSIBILITY

A. Locate equipment which must be serviced, operated or maintained in fully accessible positions.

B. Coordinate locations in ceilings requiring access lights, speakers, sprinkler heads and other items.

C. Provide access to valves, traps, clean-outs, motors, fire dampers, controllers, switchgear and drain points.

D. Visual identification shall be provided at ceiling grid access indicating what is above the ceiling that needs access, i.e., potable water shut-off valve, etc.

3.2 PAINTING AND FINISHING

A. Division 9: Refer to Section 09900, "Painting" for field painting requirements.

B. Damage and Touch-Up: Repair all marred or damaged factory painted finishes with materials and procedures to match original factory finish.

C. Identification: Provide schedules for stenciling and identification markings. Submit stenciling and identification marking for approval.

3.3 CUTTING AND PATCHING

A. Cutting: Provide cutting, channeling, chasing and drilling of floors, walls, partitions, ceilings and other surfaces necessary for installation of mechanical work. All cutting shall be performed by skilled mechanics of the trades involved.

B. Patching: Repair cut surfaces to match adjacent surfaces. Openings to accommodate mechanical systems (i.e. ductwork, piping, control wiring, etc.) shall be sealed to prevent the transmission of noise.

3.4 FIRESTOPPING

A. Firestopping: Unused slots, sleeves and other penetrations in walls or other general construction shall be closed and sealed with an approved firestopping material.
   1. Openings in walls shall be closed with 18 gage stainless steel sheet securely attached at the midpoint of the wall thickness and firestopped on both sides of the steel sheet with not less than 1/8 inch thick layer of non-sagging silicone elastomer to fully cover the opening.
   2. Firestopping material shall be UL listed and tested silicone elastomer specifically formulated for use in horizontal and vertical applications. The material shall possess intumescent characteristics; upon exposure to heat above 250°F shall expand to not less than five times its original volume to form a fireproof envelope UL rated for 2-hour and 3-hour protection, when applied in accordance with the manufacturer's recommendation.
   3. Single or multiple pipes passing through walls shall have the annular space between pipes or between pipes and structure filled with silicone elastomer to provide a 3-hour rated firestop for floors and walls.

B. Pipe and Ducts:
   1. The annulus between exposed pipe and ductwork and walls or floors in finished spaces shall be filled, sealed, and painted to match adjacent surfaces.

3.5 PIPE SLEEVES

A. Pipe sleeves shall be provided where pipes pass through masonry or concrete walls, floors, roofs and partitions. Sleeves shall be placed during construction of the building and at no time shall jack hammers be used. Sleeves in outside walls below and above grade, or in floor slabs, shall be zinc-coated sheet steel. Space between pipe, tubing or insulation and the sleeve shall not be less than 1/4 inch. Sleeves shall be held securely in proper position and location before and during construction. All sleeves shall be of sufficient length to pass through entire thickness of walls, partitions, roof decks, or floor slabs.

B. Sleeves in floor slabs shall extend 2 inches above the finished floor. Space between the pipe and the sleeve shall be firmly packed with oakum and caulked on both ends of the sleeve with insulating cement.

C. Sleeves located in waterproofed construction shall be provided with flange and clamping ring. Sleeves are not required in floor slabs located on grade except that copper pipe shall not come into concrete. All penetrations through fire rated walls and floors shall be sealed in a manner to maintain the integrity of this fire rating and meet Life Safety Codes. See above for specification of firestop material and installation requirements.

D. Sleeves for Pipes Through Non-fire Rated Floors: 18 gage stainless steel.

E. Sleeves for Pipes Through Non-fire Rated Beams, Walls, Footings, and Potentially Wet Floors: Steel pipe or 18 gage stainless steel.

F. Sleeves for Pipes Through Fire Rated and Fire Resistive Floors and Walls, and Fire Proofing: Prefabricated fire rated sleeves including seals, UL listed.

G. Sleeves for Round Ductwork: Stainless steel.

H. Sleeves for Rectangular Ductwork: Stainless steel.

I. Firestopping Insulation: Glass fiber type, non-combustible.

J. Sealant: Refer to Section 07900.

3.6 INSTALLATION - PIPE HANGER AND SUPPORTS

A. Support horizontal piping as scheduled.

B. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.

C. Place hangers within 12 inches of each horizontal elbow.

D. Use hangers with 1-1/2 inch minimum vertical adjustment.

E. Support horizontal cast iron pipe adjacent to each hub, with 5 feet maximum spacing between hangers.

F. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.

G. Support riser piping independently of connected horizontal piping.

H. Provide copper plated hangers and supports for copper piping.

I. Design hangers for pipe movement without disengagement of supported pipe.

J. Prime coat exposed steel hangers and supports. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.

3.7 PIPE HANGER AND SUPPORT SCHEDULE

PIPE SIZE Inches	MAX. HANGER SPACING Feet	HANGER ROD DIAMETER Inches
1/2 to 1-1/4	6.5	3/8
1-1/2 to 2	10	3/8
2-1/2 to 3	10	1/2
4 to 6	10	5/8
8 to 12	14	7/8
PVC (All Sizes)	6	3/8
C.I. Bell and Spigot (or No-Hub) and at Joints	5	3/8

3.8 INSTALLATION - MOTORS

A. Install securely on firm foundation. Mount ball bearing motors with shaft in any position.

B. Line up motors on direct drive dial type gauges.

C. Check line voltage and phase and ensure agreement with nameplate. Furnish circuit breakers rated for motor protection of equipment purchased under this Section but installed under Division 16.

D. Make electrical connections and test motor for proper rotation/phasing under Division 16.

E. Adjust motors together with driven equipment to insure equipment is dynamically and statically balanced. Correct any excessive vibration or noise from the equipment.

3.9 INSTALLATION - ACCESS DOORS

A. Installation of access doors shall be in accordance with manufacturer's recommendations.

3.10 OPERATING AND MAINTENANCE INSTRUCTIONS

A. After final tests and adjustments have been completed, furnish the services of qualified personnel to fully instruct members of the owner's maintenance staff in the operation and maintenance procedures for equipment installed including heat pumps, roof top units, air systems, and plumbing systems.
   1. Have the operation and maintenance instructions for major items of equipment directly supervised by the equipment manufacturer's representative.
   2. Supply qualified personnel to operate equipment for a sufficient length of time as required to assure that the owner is properly qualified to take over operation and maintenance procedures.

END OF SECTION 15010

SECTION 15400
PLUMBING

PART 1 - GENERAL

1.1 DESCRIPTION

A. The work includes the providing of all labor, materials, and services necessary to install the indicated systems, complete with hangers, supports, equipment and connections required to any fixture or equipment indicated or specified.

B. The work includes, but is not limited to the following:
1. Sanitary waste and vent piping systems.
2. Domestic hot and cold water piping systems.

1.2 ALL WORK

A. Shall be performed by mechanics skilled in the particular class of work and all equipment shall be installed in strict accordance with the manufacturer's recommendations. The work shall be coordinated with other trades and responsibilities established so that the work shall be completed without delays or interference with schedules.

1.3 CUTTING AND PATCHING

A. Where required, the Contractor shall do the cutting and patching using workers who are skilled in the trade involved. The completed work shall present a finished workmanlike appearance.

1.4 PIPING AND DRAWINGS

A. The drawings are diagrammatic and not intended to show in detail all features of the work. The location of all piping shall be coordinated to determine that it clears all openings and structural members, that piping indicated as concealed can be properly concealed in walls or partitions of finished rooms, and that it does not interfere with lights, ductwork, or equipment having fixed locations. Conceal all piping except where otherwise indicated.

1.5 OPENINGS IN EXISTING CONCRETE CONSTRUCTION

A. Shall be core drilled or cut with masonry saw. Pneumatic tools will not be permitted. The integrity of the fire rating of walls, ceilings, and floors shall be maintained and shall meet Life Safety and local codes.

1.6 ELECTRICAL WORK

A. In accordance with Division 16. Refer to electrical drawings for electrical characteristics of equipment.

1.7 EXCAVATION AND BACKFILL

A. In accordance with the section on Earthwork.

1.8 TRAPS

A. Each fixture, equipment drain or floor drain shall be separately trapped, unless otherwise indicated or specified.

1.9 UNIONS

A. Install on one side of each valve or connections to equipment.

1.10 ESCUTCHEON PLATES

A. For all piping through walls, floors, and ceilings exposed to view. Chromium plated, two piece hinged, with set screws. To fit around insulation, where present. Deep escutcheon plates shall be provided where pipe sleeves extend above floors.

1.11 SHOP DRAWINGS

A. If hard copies of shop drawings are furnished, seven (7) copies of Shop Drawings of each item listed in the "Equipment Schedules" or elsewhere on the drawings and in the specifications. (These shop drawings shall be submitted to the Project Manager and approved by him before the Contractor may purchase the equipment or materials.) Two sets will be retained by the project manager.

B. Shop drawings shall be submitted with all equipment items complete at one time. Shop drawings shall be presented in book form in a hardbacked binder with heavy paper dividers for each paragraph of the specification delineating an item or items of equipment. Dividers shall be provided with substantial staggered index tabs, with each tab numbered with the specification paragraph number for the included item(s) of equipment. In addition, an index listing each tab division with equipment covered shall be provided at the front of the submittal book. Provide a single tab labeled "DWGS" for items of equipment that might be specified on the Drawings. Items presented singly for approval will not be acceptable.

C. Coordinate the location of floor drains, piping and other pertinent items with the work of other trades. Installation of these items shall be made after receipt of and in accordance with the approved shop drawings.

1.12 GUARANTEE

A. All equipment, material, accessories and installation shall carry a guarantee against defects for a period of one year from the date of acceptance. Each system as a whole, and in all its parts, shall be guaranteed to function correctly up to the specified capacity. Should a system, or any part thereof, fails to meet the performance requirements, necessary replacements, alternations or repairs shall be made to bring performance up to specified requirements. Building construction finishes damaged or marred shall be restored to the satisfaction of the Owner's representative. All of the above described shall be done without cost to the Owner.

1.13 UNIONS AND FLANGES

A. Unions and flanges may not, in every case, be shown on the Drawings, but are to be provided where necessary and adjacent to all equipment installed or provided for under this contract.

PART 2 PRODUCTS

2.1 GENERAL

A. All materials shall be new and free from all defects. These specifications list all of the acceptable materials for a given service, one of which shall be used unless otherwise specifically noted in the specifications or on the Drawings.

B. The quality and weight of materials furnished and installed shall comply with the requirements and specifications of the appropriate standards of the American Society for Testing and Materials (ASTM), Life Safety Code and the local plumbing code.

2.2 PIPE AND FITTINGS

A. General: All piping shall be run straight, plumb and properly graded in direction indicated on the Drawings. Cut pipe shall be squarely cut and properly reamed to remove all cuttings and burrs before making up the joints. Fittings and nipples shall be of the same materials as the pipe.

B. Waste and Vent Plastic Pipe and Fittings: Pipe shall be Schedule 40 PVC conforming to ASTM D1785. Fittings shall be PVC conforming to ASTM D2665. Solvent cement joints shall be made in a two-step process with primer conforming to ASTM F 656 and solvent cement conforming to ASTM D 2564

C. Water Plastic Pipe and Fittings: Pipe and fittings shall be Schedule 40 CPVC conforming to ASTM D2846. Pipe and fittings shall conform to NSF Standards 14 and 61. Solvent cement joints shall be made in a two-step process with primer conforming to ASTM F 656 and solvent cement conforming to ASTM D 493.

2.3 VALVES

A. General: Crane valve numbers are specified to establish type and quality. Equivalent valve types by Fairbanks, Hammond or Powell will be considered for approval.

B. Domestic Water Piping:
1. Hose Bibb: Chicago Faucets #387 with Watts No. 8A backflow preventer. Key operated handles.
2. Ball Valves: Full port ball valves with stainless steel stem and ball with teflon seat and rings.

C. All valves in piping to be insulated shall have extended stems.

2.4 CLEANOUTS

A. Where indicated and at the base of all risers. Additional cleanouts at the Contractors' option for the convenience of testing and erection. Cleanouts installed in floors with waterproof membrane shall be provided with clamping rings. Install cleanout frames and covers to be flush with the adjoining architectural finishing material. Clean-outs located outside the building shall be two-way type. Josam Model Numbers are indicated below. Comparable model numbers by Wade or J. R. Smith will be considered for approval.

B. Cleanout Plugs: Josam 58540-20.

C. Cleanouts in Wall: Josam 58790-22.

D. Cleanouts in Concrete and Terrazzo Floor Finishes: Josam 58460.

2.5 PIPE HANGERS

A. Hangers shall be of the clevis type, MSS SP-58, type 1.

2.6 WATER HAMMER ARRESTORS

A. In conformance with Plumbing and Drainage Institute No. PDI-WH-201.

2.7 PLUMBING FIXTURES

A. General: All plumbing fixtures shall be "First Quality". All enameled iron fixtures shall have acid resisting white enamel. All fixtures and fittings proposed shall be from one manufacturer and of similar character. Escutcheons, handles, etc., on the different fixtures shall be of the same design. All fixtures and fittings proposed shall be submitted for approval with catalog cuts and full description. All exposed metal and piping not otherwise specified shall be polished chromium on brass or bronze. All water supply to fixtures shall be provided with stops of the loose key type.

B. See Drawings for fixture specifications. Where fixture types refer to those manufactured by American Standard, unless otherwise noted, these numbers are used to indicate type and quality of fixtures desired. Fixtures of equal quality manufactured by Kohler, Briggs, Crane or Eljer will be considered for approval. Trim by Chicago or T&S Brass will be considered for acceptance. Hanger supports and carriers shall be installed in accordance with manufacturers' recommendations.

2.8 EQUIPMENT FURNISHED BY OTHER SECTIONS

A. Certain items of equipment will be furnished as work of other sections and shall be furnished with necessary plumbing services as work of this section, responsibility includes determining the correct roughing location for services and making final connections.

B. Piping and Valves necessary to supplement those items which are furnished by other sections shall be furnished and installed by this section. Provide shut-off valves on all supply branches to equipment. All piping and valves in finished room normally exposed to view shall be brass, chromium plated, and provided with chromium plated escutcheon plates.

2.9 THERMAL INSULATION

A. General: No insulation shall be installed until the piping systems have been checked and found free of all leaks. Surfaces shall be clean and dry before attempting to apply insulation. Insulation shall be installed by a professional insulation contractor with adequate experience and ability to perform the work. The Contractor shall verify that all materials comply with the specifications.

B. Domestic Hot Water Piping:
   1. Material: Shall be insulated with one-inch thick Johns-Manville Flame Safe AF-T fiberglass pipe insulation.
   2. Application: Prior to installing the insulation, the pressure release paper shall be removed from the jack laps. Pipe insulation shall be secured in place by applying pressure to the pressure sensitive closure system. Elbows shall be insulated with Johns-Manville Unifit PVC fitting covers. Valves and other irregular shaped fittings shall be insulated with pipe insulation segments and finished with a skim coat of air drying Johns-Manville 375 cement and white glass fabric dipped in Foster’s 30-60 coating or equal.

C. Domestic Cold Water Piping:
   1. Material: Shall be the same material and applied in the same manner as specified above for domestic hot water piping.

PART 3 EXECUTION

3.1 SOIL, WASTE, AND VENT PIPING

A. Buried Piping: Soil and waste pipe and fittings below the floor slab and to the building five foot

line shall be of the Schedule 40 PVC.

B. Above Grade: Soil, waste, and vent piping and fittings shall be Schedule 40 PVC plastic.

3.2 DOMESTIC HOT AND COLD WATER PIPING

A. Pipe shall be Schedule 40 CPVC.

3.3 CLEANING AND PROTECTION OF PIPE

A. Before being placed in position, pipe and fittings shall be cleaned carefully. All pipe shall be maintained in a clean condition.

3.4 PIPE IN TRENCHES

A. Sewer and water piping shall be placed in separate trenches.

B. Water piping shall be buried at a depth of six inches below the frost line or a minimum of 12 inches, whichever is greater.

3.5 INSTALLATION OF SCREW-JOINTED PIPING (IF USED)

A. All piping shall be cut accurately to measurements established by the Contractor and shall be worked into place without springing or forcing. Proper provision shall be made for the expansion and contraction of all pipe lines. Pipe and fittings shall be free from fins and burrs. Screw joints in water piping shall be made with a lubricant applied on the male threads only. Threads shall be full cut and not more than three threads on the pipe shall remain exposed. Unions and union type connections and shut-off valves shall be provided for all fixtures and equipment ready for disconnection. Pipe hung shall be supported by heavy, adjustable hangers conforming to MSS SP-59. All hangers and collars shall be of sizes suitable for the weight of the pipe and the contents in it. All changes in sizes of pipe shall be made with reducing fittings.

3.6 WATER HAMMER ARRESTORS

A. Water hammer arrestors shall be provided instead of site-fabricated air chambers, and shall be sized as required and installed in accordance with manufacturer's recommendations.

3.7 SANITARY SYSTEMS

A. Sanitary and storm systems shall be provided where applicable, with Y fittings and 1/8 or 1/16 bends or combination Y and 1/8 bends. All fixtures not specified to be provided with traps as integral parts of their outfits and all drains shall have separate traps with cleanouts. Waste and storm lines shall not be less than 2 inches in diameter. All fixtures shall be individually vented, or shall be connected to a vented soil or waste line. Unless indicated otherwise, sanitary piping shall form circuit or loop vents with no dead ends or inverted siphons. Circuit or loop vent lines shall be connected at a height of not less than 12 inches above the fixtures served. Horizontal vents shall slope down to waste or soil branch or stack. Horizontal soil, waste and storm piping, generally, shall be graded 1/8 inch per foot. Vertical stacks shall be extended full size as vents to not less than 12 inches above the roof and shall be placed in position before the roofing is applied. Where practicable, two or more vent lines may be connected and extended as one pipe through the roof. Cleanouts shall be installed at the foot of each soil or waste line, at changes in direction in the lines, and where indicated; however, within the buildings, the distance between cleanouts in horizontal runs shall in no case exceed 50 feet. Cleanouts in floors shall be extended full size to the floor level with outlets fitted with trap screws with countersunk caps. Clean-outs shall be pipe size except no cleanout shall exceed 6 inches in diameter. Vent flashing at the roof shall extend not less than 8 inches from the vent pipe in all

directions. Lead flashing shall be turned down into the pipes or hubs.

3.8 WATER SYSTEMS

A. Water systems shall be installed with a fall towards the shut-off valve or the lowest fixture. Branches from hot and cold water lines shall be provided to fixtures, water heating units, and outlets as indicated.

3.9 WATER VALVES

A. Water valves shall be installed in accessible places and shall be located as follows:
   1. Valve with hose connection on the building side of the main shut-off valve
   2. Shut-off valve on each supply to each fixture not provided with compression stop
   3. Valves shall be provided on all branches serving more than one fixture.

3.10 INSTALLATION OF FIXTURES

A. Connections between water closets and the flanges on soil pipe shall be made gas and water tight with one piece special molded gasket. All bulk material including putty and plastics shall not be used. Floor drains shall be secured to the waterproofing or flashing in a water tight manner. Exact rough-in locations for fixtures and floor drains shall be determined from the existing conditions.

3.11 SUPPORTS AND FASTENINGS

A. Plumbing fixtures, trimmings, accessories and appurtenances shall be secured to concrete by 1/4 inch brass expansion bolts not less than 4 inches long, and to gypsum with steel plates 1/8 inch thick, 6 inches wide and not less than 24 inches long at the back of the through bolts. Expansion bolts shall be of a length sufficient to extend at least 3 inches into solid concrete. Through bolts shall be provided with plates or washers at the back and set so that heads, nuts, and washers will be concealed by the wall material. Bolts and nuts shall be stainless steel hexagons with rounded tops. Stainless steel washers shall be provided.

3.12 PIPE SLEEVES

A. Pipe sleeves shall be provided where pipes pass through masonry or concrete walls, floors, roofs and partitions. Sleeves shall be placed during construction of the building and at no time shall jack hammers be used. Sleeves in outside walls below and above grade, or in floor slabs, shall be sheet aluminum. Space between pipe, tubing or insulation and the sleeve shall not less than 1/4 inch. Sleeves shall be held securely in proper position and location before and during construction. All sleeves shall be of sufficient length to pass through entire thickness of walls, partitions or slabs. Sleeves in floor slabs shall extend 2 inches above the finished floor. Space between the pipe and the sleeve shall be firmly packed with oakum and caulked on both ends of the sleeve with insulating cement. Sleeves located in waterproofed construction shall be provided with flange and clamping ring. Sleeves are not required in floor slabs located on grade except that copper pipe shall not come into concrete. All penetrations through fire rated walls and floors shall be sealed in a manner to maintain the integrity of this fire rating and meet Life Safety Codes. See specification Section 15010 for specification of firestop material and installation requirements.

3.13 STERILIZATION

A. Prior to starting work, verify system is complete, flushed and clean.

B. Ensure PH of water to be treated is between 7.4 and 7.6 by adding alkali (caustic soda or soda ash) or acid (hydrochloric).

C. Inject disinfectant, free chlorine in liquid, powder, tablet or gas form, throughout system to obtain 50 to 80 mg/L residual.

D. Bleed water from outlets to ensure distribution and test for disinfectant residual at minimum 15 percent of outlets.

E. Maintain disinfectant in system for 24 hours.

F. If final disinfectant residual tests less than 25 mg/L, repeat treatment.

G. Flush disinfectant from system until residual equal to that of incoming water or 1.0 mg/L.

H. Take samples no sooner than 24 hours after flushing, from 10 percent of outlets and from water entry, and analyze in accordance with AWWA C651.

I. A testing firm company specializing in testing potable water systems shall be approved by the State.

J. A Certificate shall be submitted to Owner that cleanliness of water distribution system meets or exceeds the state health department requirements.

K. On renovation work, all procedures required above will be required for piping downstream of any shut-off valve turned off in order to do the work.

L. If building is to be occupied, Contractor shall provide bottled water until Certificate has been received.

3.14 ANCHORING, GUIDING AND SUPPORTING OF PIPING

A. All piping shall be anchored and supported in a manner such that expansion and contracting will take place in the direction desired and vibration and undue strains on equipment will be prevented by use of vibration dampeners. Hangers used for the support of piping, 2 inch nominal pipe size and larger, shall be fabricated to permit adequate adjustment after erection while still supporting the load. Wall brackets shall be used where pipes are adjacent to wall or other vertical surfaces that may be used for supports. Supports shall be provided with a type 40 pipe covering protection saddle at each support in accordance with Table 4 of SP-69. Pipe supports shall be spaced to provide adequate support for the pipes, the medium in the pipe, insulation, valves and fittings; spacing of supports shall be such as to prevent the forming of pockets. The maximum horizontal spacing for metal piping between pipe supports shall conform to Table 3 of MSS SP-69, except that cast iron soil pipe shall have a maximum spacing between hangers of 5 feet. Vertical piping shall be supported by bolted steel clamps or type conforming to MSS SP-69. Pipe hangers shall be isolated from uninsulated metal pipe with neoprene pads such that the pipe will not vibrate within the support.

3.15 INSTRUCTION MANUALS

A. Furnish four complete copies of instructions explaining operation and maintenance and replacement parts lists of the following equipment:
   1. Flush Valves
   2. Faucet Trim
   3. Electric Water Heaters

3.16 SAFETY CODE

A. All piping in accordance with ANSI A13.1981.

3.17 AS-BUILT DRAWINGS

A. Provide a complete set of reproducible "As-Built" drawings at job completion. Upon request, the Architect will provide the Contractor with reproducible copies of the contract drawings for the use in making these "As-Built" drawings.

3.18 FIELD TESTS

A. Water supply piping shall be subjected to a hydrostatic pressure test of 100 psi minimum. Pressure shall be maintained on the lines for a period of time sufficient to examine the entire system but not less than one hour.

B. Sanitary Piping: Before the installation of any fixtures, the vents of the system shall be capped and all lines filled with water to the roof and allowed to stand until a thorough inspection has been made. After the fixtures are set, a smoke or equivalent test shall be made using a suitable apparatus.

END OF SECTION 15400

SECTION 15512

CONDENSATE DRAIN PIPING

PART 1 GENERAL

1.1 SUMMARY

A. Scope: Provide condensate drain piping from cooling coil drain pans. Drain piping shall be routed to the nearest floor drain except as otherwise indicated on the drawings.

B. Related Sections: Refer to other Division 15 sections for the following:
   1. Mechanical Identification.
   2. Mechanical Insulation.
   3. Firestopping.

C. Other Divisions: Refer to other Divisions of the specification for the following:
   1. Field Painting: Division 9.
   2. Piping systems requiring fixed locations and slopes shall have priority over those which do not have both requirements.

1.2 QUALITY ASSURANCE

A. Codes and Standards: Provide piping and fittings conforming to the requirements of the following:
   1. American Society for Testing and Materials (ASTM):
      a. B16.22 Standard Specification for Wrought Copper and Copper Alloy Solder Joint Pressure Fittings
      b. B16.23 Standard Specification for Cast Solder Fittings
      c. B16.29 Standard Specification for Wrought Solder Fittings
      d. B88 Standard Specification for Seamless Copper Water Tube
      e. B306 Standard Specification for Seamless Copper Waste and Vent Pipe
      f. D2665 Standard Specification for Polyvinyl Chloride Piping

1.3 SUBMITTALS

A. Division 1: Refer to Section 01300, "Submittals" for basic information relating to submittal requirements.

B. Product Data: Submit manufacturer's standard technical product data indicating conformance to the stipulated reference specifications, construction materials, construction details, and test and operating pressures. Submit manufacturer's product data on the following:
   1. Pipe materials.

1.4 STORAGE AND PROTECTION

A. Storage: Store piping on the project site so as to preclude the entrance of construction dirt and debris into the open ends of piping. Do not install piping fouled with construction dirt.

B. Storage of Fittings: Store fittings under cover, protected from construction dirt and rain.

PART 2 PRODUCTS

2.01 PIPING MATERIALS

A. Piping shall be PVC as specified provided it is in accordance with all applicable codes and ordinances.

PART 3 EXECUTION

3.01 GENERAL

A. Piping shall be sloped uniformly toward floor drain and provided with trap seal having a depth, in inches, equivalent to the total static pressure of the respective fan system plus two inches.

B. Piping shall be installed in a neat and workmanlike manner and shall not be smaller than full size of the equipment drain connection or three-quarters inch (3/4") whichever is larger.

3.02 INSTALLATION

A. Sizes: Provide piping systems of sizes indicated on the drawings. Systems shall be installed complete.

B. Codes: Install piping systems in conformance with all applicable codes.

C. Pitch: Install condensate drain piping with a pitch or slope of not less than 1/4" per foot in the direction of flow.

3.03 ROUTING

A. Unless otherwise indicated, route pipe discharge to the exterior.

END OF SECTION 15512

SECTION 15670

SPLIT SYSTEM AIR CONDITIONING SYSTEMS

PART 1 GENERAL

1.1 SUMMARY

A. Scope: Extent of split system air conditioning unit work required by this Section is indicated on drawings and schedules, by requirements of this Section, and Section 15010, "Mechanical Basic Requirements."

B. Types: Types of split system air conditioning units specified in this Section include the following:
1. Air-cooled split system air conditioning units.
2. Ducted fan coil units.

C. Related Sections: Refer to other Division 15 sections for the following:
1. Pipe Insulation
2. Field-Installed Controls and Interlock Wiring
3. Testing, Adjusting and Balancing

D. Other Divisions: Refer to other divisions of the specifications for the following:
1. Power Wring.
2. Disconnect Switches.
3. Equipment Pad.
4. Anchoring to Equipment Pad.

1.2 QUALITY ASSURANCE

A. Codes and Standards: Provide split system air conditioning units conforming to the following requirements:
1. Air-Conditioning and Refrigeration Institute (ARI): Rate in conformance with ARI 210, "Standard for Unitary Air-Conditioning Equipment," and ARI 270, "Standard for Sound Rating of Outdoor Unitary Equipment" for units up to 7½ ton capacity.
2. ARI: Rate, test and certify that the units are in conformance with ARI 520, "Standard for Positive Displacement Refrigerant Compressors, Compressor Units and Condensing Units" for units up to 200 ton capacity. Units not in conformance at time of will not be accepted.
3. American National Standards Institute (ANSI): Construct and rate in accordance with ANSI B19.1, "Safety Standard for Air Compressor Systems."
4. American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE): Construct and rate in conformance with ASHRAE 15, "Safety Code for Mechanical Refrigeration."
5. ANSI/ASHRAE: Refrigerants shall be numbered and classified in accordance with ANSI/ASHRAE 34-1992 and 34a-1993, "Number Designation and Safety Classification of Refrigerants. "
6. Underwriters Laboratories, Inc. (UL) or Electrical Testing Laboratories (ETL): Provide units with UL or ETL listing and label.

B. Field Tests: Split system air conditioning units and their associated fan coil units shall meet field testing requirements of paragraphs in Part 3 of this Section.

C. Each unit, in its entirety, shall be warranted for one year against defects in materials and

workmanship and the refrigeration compressor shall have an additional four year warranty.

1.3 SUBMITTALS

A. Division 1: Conform to the requirements of Division 1, Section 01300, "Submittals."

B. Product Data: Submit manufacturer's product data, including rated capacities, weights, furnished specialties and accessories and installation and start-up instructions.

C. Drawings: Submit manufacturer's drawings indicating dimensions, required clearances, and refrigeration component balance diagram.

D. Wiring Diagrams: Submit ladder-type wiring diagrams for power and control wiring. Differentiate between portions of wiring that are factory-installed and portions to be field-installed.

E. Field Test Plan: Submit test plan for split system air conditioning unit tests specified in Part 3 of this Section. Plan shall include test schedules and names and titles of the test personnel who will be participating in the Field tests. The test personnel must be employees of the split system air conditioning unit manufacturer, the manufacturer's designated representatives or employees of an independent testing agency regularly engaged in testing of similar equipment. Plan shall include false loading of units if the anticipated building loads at the time of test do not meet the scheduled capacity requirements. Submittal shall have detailed layout for temporary equipment, if such equipment are needed, even if they are not specified or shown on drawings.

F. Maintenance Data: Submit maintenance data and parts list for each split system air conditioning unit, control, and accessory.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Delivery: Handle split system air conditioning units carefully to prevent damage, denting and scoring. Do not install damaged units or components; replace with new.

B. Storage: Store split system air conditioning units and components in a clean dry place. Protect from weather, dirt, water, and construction debris.

PART 2 PRODUCTS

2.1 AIR-COOLED SPLIT SYSTEM AIR CONDITIONING UNITS:

A. General: Provide factory-assembled and tested air-cooled split system air conditioning units, of type, quantity and size indicated on the schedules and the drawings, and suitable for operation in the locations indicated. Units shall be compatible with the air handling units. Units shall be treated with corrosion protection as specified in this section of the specifications. Units shall come prewired such that only one point of connection for electrical power is required.

B. Casing: Provide casings as follows:
1. Weatherproof for outside installation.
2. Construct of 18 gage galvanized steel, zinc phosphatized with baked enamel or air dried powder factory finish and removable access panels to compressors, controls and all serviceable components.
3. Provide hinged or lift-out doors with handles and twist-lock hardware. Sheet metal screws will not be acceptable.
4. Provide removable cadmium plated or vinyl coated fan guards and condenser coil inlet guards.

5. Provide lifting lugs welded to a rigid galvanized steel base.

C. Compressors: Provide reciprocating, accessible hermetic or hermetic compressor with bolted, removable heads, crankcase oil heater, suction and discharge cap seal, suction and discharge shut-off valves with gauge taps, maximum 1750 rpm.
1. Provide positive displacement oil pump with factory set oil pressure regulating valve.
2. Provide oil level sight glass, oil filter or strainer, and magnetic plug.
3. Provide a suction gas cooled motor with high temperature motor protection, and suction pressure or electric actuated unloaders. Motor stator winding shall be NEMA rated Class F suitable for operation in a refrigerant atmosphere.
4. Provide refrigerant and oil charge for complete and operable systems.

D. Condenser: Provide an air cooled condenser with seamless copper tube with aluminum fins.
1. Space fins for cleaning. Maximum 200 per foot.
2. Provide separate and independent refrigerant circuits for each compressor.
3. Provide liquid accumulator and sub-cooling circuit.
4. Design and test for 300 psig, factory dehydrate and charge.
5. Provide propeller-type direct drive fans with aluminum or corrosion resistant steel blades, totally enclosed, permanently lubricated squirrel-cage motors, NEMA Code Letter C.
6. Provide fan contactors, with overloads in weatherproof housing.

E. Low Ambient Controls: Provide low ambient controls to allow operation at or below ambient temperatures scheduled.

F. Controls: Provide operating controls in a factory-installed weatherproof enclosure. Provide, as a minimum, fan fuses and terminal blocks, fan contactors one per fan, control power circuit transformer and power connection terminal block.
1. Provide molded case circuit breakers or motor circuit thermal protectors with thermal overload trips for each compressor.
2. Provide compressor contactors.
3. Provide recycling pump down relay and manual pump down switch.
4. Provide high and low pressure cutout relays for each compressor.
5. Provide oil pressure cutout switch for each compressor.
6. Provide sequencing relay for multiple compressor units.
7. Provide a 5 minute compressor restart timer to prevent short-cycling on power failure.

G. Piping: Provide pre-charged and insulated suction and liquid tubing of copper conforming to American Society of Testing and Materials (ASTM) B 88, "Standard Specification for Seamless Copper Water Tube."

2.2 DUCTED FAN COIL UNIT

A. Cabinet
1. Pre-painted galvanized steel cabinet
2. High-density R-4.2 insulation
3. Sweat connections
4. Inspection plate for cleaning A-coil design
5. Cabinet must meet requirements of a 2% cabinet leakage rate when tested at 1.0 inches of static pressure.

B. Cooling Coil
1. Grooved copper tubing
2. Lanced sine-wave aluminum fin
3. Fully--wettable coil

C. Condensate Drain Pan

1. High-impact thermoplastic condensate pan
2. Primary and secondary drain connections with brass inserts

D. Electric Heater - Field-installed at discharge of unit.

E. Operation:
1. Control board with built--in, replaceable 5--amp blade--type auto fuse
2. Multi-speed motor
3. Cooling controls
4. Time--delay relay (TDR)
5. 40-VA, 208/230v transformer
6. All models listed with UL and ARI

2.3 CORROSION PROTECTION

A. Bronze Glow Coating
1. All coil(s) (condenser, evaporator, reheat, etc.) will have the refrigerant removed and stored for later installation.
2. All copper tubing will be capped and coil charged with 200 lbs. of nitrogen to insure no leaks develop in the coating process.
3. Coils are to be removed from the HVAC units and :
   a. Cleaned with Bronz-Glow cleaners & hot treated water.
   b. Spray primed with Bronz-Glow " Husky Gold Primer ".
   c. Dip coated (submerged in tank) with Bronz-Glow "Husky Gold Protectant".
4. All copper tubing, compressors, and metal components in the unit will be cleaned, primed and protective coated with Bronz-Glow "Component Coat" (Husky Gold can also be used for this function).
   a. Components include: All metal devices attached to the copper tubing, such as filter dryers, receivers, reversing valves, compressors, solenoids, sensors, etc.
   b. Condenser fan motor and blades – only when specifically approved by a JEA Facilities foreman.
   c. Evaporator Blower assembly – only when specifically approved by a JEA Facilities foreman.
   d. Interior Cabinetry – only when specifically approved by a JEA Facilities foreman.
5. All brazed soldered joints (due to their combination of metals) are very susceptible to corrosion and deteriorate faster than the rest of the copper. These joints will get extra cleaning to remove any patina, primer and double the normal amount of protectant coat.
6. Once treated, the coil(s) will be reinstalled into the unit, the unit will be evacuated, recharged with refrigerant, inspected, and readied for shipment.

2.4 MANUFACTURER

A. Ductless systems scheduled are by Mitsibishi. Equivalent units by Carrier Corporation, The Trane Company, or Johnson Controls are acceptable providing they meet all requirements of the specifications.

B. Ducted systems scheduled are by Carrier Corporation. Equivalent units by Johnson Controls, The Trane Company, or Lennox are acceptable providing they meet all requirements of the specifications.

PART 3 EXECUTION

3.1 INSPECTION

A. Support: Conform to manufacturer's clearance, support and installation requirements.

B. Entrance Dimensions: Verify equipment building entrance requirements.

3.2 INSTALLATION OF SPLIT SYSTEM AIR CONDITIONING UNITS

A. General: Install split system air conditioning units in accordance with manufacturer's installation instructions.

B. Install units on minimum four inch high concrete pad, four inches larger on each side than chiller base. Cast anchor bolts into the pad.

C. Refrigerant Piping: Install in strict accordance with manufacturer's requirements and ASHRAE recommendations.

D. Electric Wiring: Provide control and interlock wiring as speci-fied, conforming to manufacturer's requirements. Coordinate field-installed automatic temperature control wiring with Section 15993 "Sequence of Operation."

E. Field Test: Field tests during split system air conditioning unit installation and start-up tests shall not be considered as fulfilling requirements of Field tests.

3.3 INSTALLATION OF DUCTED FAN COILS

A. General: Install fan coil units where indicated on the drawings, in accordance with equipment manufacturer's published installation instructions.

B. Access: Provide access space around fan coil units for service as indicated on the drawings, but in no case less than that recommended by the manufacturer.

C. Support: Install floor-mounted fan coil units on four inch high concrete pads, four inches larger on each side than unit base. Units that are to be suspended are to be mounted with vibration isolators and provided with a secondary drain pan suspended under the entire unit. Provide a drain from the drain pan to drain in an obvious location or provide a float switch which turns the unit off if water is detected in the pan.

D. Electrical Wiring: Install electrical devices furnished by manufacturer but not specified to be factory-mounted.

1. Verify that electrical wiring installation is in accordance with manufacturer's submittal and installation requirements of Division 16 sections.

E. Piping Connections: Provide piping, valves, accessories, gauges, supports, and flexible connections as required to have a properly operating system. Trap fan coil unit drain-pan connections according to manufacturer's recommendations. Connect unit drain to nearest indirect waste connection. Provide trap at drain pan; construct with at least 2 inch deeper than fan pressure rating.

F. Duct Connections: Provide ductwork, accessories, and flexible connections as indicated on the drawings. Provide transitions to exactly match unit duct connection size.

3.4 INSTALLATION OF DUCTLESS FAN COILS

A. General: Install fan coil units where indicated on the drawings, in accordance with equipment manufacturer's published installation instructions.

B. Access: Provide access space around ductless fan coil units for service as indicated on the drawings, but in no case less than that recommended by the manufacturer.

C. Support: Install wall-mounted fan coil units on wall where shown.

D. Electrical Wiring: Install electrical devices furnished by manufacturer but not specified to be factory-mounted.

E. Verify that electrical wiring installation is in accordance with manufacturer's submittal and installation requirements of Division 16 sections.

F. Piping Connections: Provide piping, valves, accessories, gauges, supports, and flexible connections as required to have a properly operating system. Trap fan coil unit drain-pan connections according to manufacturer's recommendations. Connect unit drain to nearest indirect waste connection.

3.5 FINAL TESTING

A. Preparation for Tests: Before the scheduled field tests, the Contractor and/or the manufacturer's representative shall have prepared the split system air conditioning units in accordance with the recommendations of the manufacturer for start-up and operations.

B. False Load: If the required test capacity of the split system air conditioning unit is greater than the building load at the time of test, false load shall be supplied. Temporary equipment or building equipment may be used to provide the load.

C. Full Load Test:
1. Split system air conditioning units shall be tested to deliver the specified cooling capacity under the specified conditions as listed in the equipment schedule. During the test, the specified conditions shall be maintained. The electric power input to the compressors shall not be more than those shown in the equipment schedule.
2. The entire cooling system (split system air conditioning units and their matching evaporators) must be under steady state conditions for a minimum of one hour before test data are taken.
3. Test data for the entire cooling system capacity and energy input shall be collected for a minimum of 30 minutes under steady state conditions. Test data shall be recorded in not longer than 5 minute intervals and shall be averaged or integrated with time.
4. Requirements for heat exchanger capacity measurement are specified in Section 15990, "Testing, Adjusting and Balancing."

D. Operational Control Test: Demonstrate proper functioning of the operational controls of the split system air conditioning units. Confirm proper operation for the following.
1. Crankcase heater.
2. High and low pressure cutouts.
3. Time temperature sensitive cycling relay.
4. Crankcase oil heater.
5. Oil pumping system.
6. Compressor unloaders.
7. Pump down operation.
8. High and low pressure cutouts for each compressor.

9. Oil pressure cutout for each compressor.
10. Sequencing relay for multiple compressor units.
11. Time cycling relay.
12. Low ambient controls.
13. Demonstrate split system air conditioning unit capacity control by varying the space or unit load. The capacity range to be tested shall be from no load to full load and back to no load. The split system air conditioning unit must demonstrate stable operation without excess vibration and noise. Each step of the multi-step control (cylinder unloading and/or compressor staging) must be verified.
14. Demonstrate that manual resetting is required to restart compressors for all safety cutouts.
15. Variables to activate safety control actions may be simulated.
16. All safety control tests must be verified by electric signals at the compressor motor starters or actual stopping of the compressors.
17. Demonstrate proper functioning of all indicating lights.

3.6 TRAINING OF PERSONNEL

A. Training: For systems 10 tons and larger, provide the services of a manufacturer's technical representative for one eight-hour day. Give instructions in operation, start-up, shut-down and maintenance.
1. Schedule training, in writing, seven days in advance.
2. Obtain concurrence for training schedule.
3. Deliver four copies of operating, maintenance, repair parts list, and factory service.

END OF SECTION 15670

SECTION 15865
FANS

PART 1 - GENERAL

1.1 SUMMARY

A. Scope: Extent of special fan work required by this Section is indicated on the drawings and schedules, by the requirements of this Section, and Section 15010, "Mechanical Basic Requirements."

B. Types: Types of special fans specified in this Section include the following:
1. Sidewall Fans
2. Roof Mounted Utility Fans
3. Roof Mounted Supply Fans
4. Cabinet Fans

C. Related Sections: Refer to other Division 15 sections for the following:
1. Vibration Isolation.
2. Sheet Metal Ductwork.
3. Testing, Adjusting, and Balancing.

D. Division 16: Refer to Division 16 sections for requirements for the following:
1. Power Wiring.
2. Magnetic and Manual Starters.
3. Disconnect Switches.

1.2 QUALITY ASSURANCE

A. Codes and Standards: Provide special fans conforming to the following codes and standards:
1. Air Movement and Control Association, Inc. (AMCA): Provide special fans conforming to applicable AMCA including the following:
a. 99 Standards Handbook.
b. 210 Laboratory Methods of Testing Fans for Rating Purposes.
c. 300 Reverberant Room Method for Sound Testing of Fans.
2. National Electrical Manufacturers Association (NEMA): Provide motors and electrical accessories complying with NEMA MG 1, "Motors and Generators."
3. Underwriters Laboratories, Inc. (UL): Provide power ventilators which are designed, manufactured, and tested in accordance with UL 705, "Power Ventilators."

B. Tests: Fans shall meet the requirements of paragraphs in Part 3 of this Section.

1.3 SUBMITTALS

A. Division 1: Conform to the requirements of Division 1, Section 01300, "Submittals."

B. Product Data: Submit manufacturer's cataloged information including:
1. Material specifications.
2. Construction details.
3. Capacity ratings.
4. Fan performance curves indicating operating points.
5. Gauges and finishes of materials.
6. Dimensional drawings.
7. Weights.
8. Accessories Furnished.
9. Motors and Drives.

C. Shop Drawings: Submit shop drawings showing unit dimensions, required clearances, construction details, methods of assembly of components, and field connection details.

D. Certifications: Submit certified performance data and sound power data for each fan to be installed at the actual speeds required. Fan curves shall show static pressure, brake horsepower, and static efficiency plotted against air volume.

1.4 SPARE PARTS

A. Belts: Provide one new spare set of belts for each fan furnished under this Contract.
   1. Mark each belt assembly with the associated fan number.
   2. Hang the span belts on a contractor furnished device on the utility room wall.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Handling: Handle fans and components carefully to prevent damage, denting and scoring.

B. Storage: Store fan components in a clean, dry place. Protect from weather, dirt, water, construction debris and physical damage.

C. Rigging: Comply with manufacturer's rigging and installation instructions.

D. Access: Verify building access limitations before delivery to the site.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. The cabinet fan scheduled is by Twin City Blower. Equivalent units by Acme Engineering and Manufacturing Corporation, Loren Cook Company, or Greenheck Fan Corporation are acceptable providing they meet all requirements of the specifications.

B. All other units scheduled are by Aerovent. Equivalent units by Acme Engineering and Manufacturing Corporation, Loren Cook Company, or Greenheck Fan Corporation are acceptable providing they meet all requirements of the specifications.

2.2 SIDEWALL FAN

A. General: Fans, where indicated on drawings and schedules shall be of the size and capacity as indicated in the fan schedule. Fans shall be tested and certified in accordance with ANSI/ASHRAE 51-1985 and ANSI/AMCA 210-85 test codes and guaranteed by the manufacturer to deliver at the rated published performance levels. In addition, each unit shall be factory run tested prior to shipment. Fans shall be licensed to bear the AMCA Certified Rating Seal for Air Performance.

B. Construction: The fan casing shall be constructed of mild steel with an integral deep spun orifice. The housing shall be 14-gauge. Construction for Reverse Flow Fans shall be accomplished by adding a half orifice to the outlet venturi. Direct Drive Panel and Ring Fans shall be constructed with a welded reinforced motor base plate which is supported by a welded spider type frame. The reinforced motor base plate shall be welded to the leaving airside of the panel. This construction allows for mounting the unit from the flanged front entrance orifice.

C. Propellers: The airfoil fan blades and hub shall be cast of 319 aluminum alloy. The propeller shall be mounted directly on the motor shaft with split taper lock bushings.

D. Balancing: The propeller assembly shall be statically and dynamically balanced in accordance with ANSI/AMCA 204-96 “Balance Quality and Vibration Levels for Fans” to Fan Application Category BV-3, Balance Quality Grade G6.3. In addition, direct drive fan propellers shall be balanced on the motor shaft after final assembly in the fan casing, in the manufacturing facility, to the following peak velocity values, filter-in, at the fan test speed:

Fan Application Category	Rigidly Mounted (In/Sec)	Flexibly Mounted (In/Sec)
BV-3	0.15	0.20

E. Motors: Fan motors shall be foot mounted NEMA Design B, standard industrial, continuous duty, ball bearing, variable torque type suitable for operation on voltage, phase and hertz, as listed in the fan schedule. Motor bearings shall have a minimum L-10 life, as defined by AFBMA, of at least 40,000 hours (200,000 hours average life).

F. Finish: The unit, after fabrication, shall be cleaned and chemically pretreated by a phosphatizing process and shall be painted inside and outside with an air dry enamel.

G. Accessories: See schedule and details for accessories.

2.3 ROOF MOUNTED UTILITY FAN

A. General: Provide single width, single inlet fan each with fan, fan housing and supports.

B. Performance: Performance ratings shall conform to AMCA Standard 205 (fan efficiency grade), 211 (air performance) and 311 (sound performance). Fans shall be tested in accordance with ANSI/AMCA Standard 210 (air performance) and 300 (sound performance) in an AMCA accredited laboratory. Fans shall be licensed to bear the AMCA certified ratings seal for both sound and air, and fan efficiency grade (FEG). Fans shall have a sharply rising pressure characteristic extending through the operating range and continuing to rise beyond the peak efficiency to ensure quiet and stable operation. Fans shall have a non-overloading design with self-limiting horsepower characteristics and shall reach a peak in the normal selection area. All fans shall be capable of operating over the minimum pressure class limits as specified in AMCA Standard 99.

C. Housings: Fan housings shall be of heavy gauge, continuously welded construction. Housings with lock seams or partially welded construction are not acceptable. Discharge flanges are to be provided for rigidity and duct connection. Housings shall be suitably braced to prevent vibration or pulsation. Housings shall have tapered spun, aerodynamically designed inlet cones or funnels providing stable flow and high rigidity.

D. Wheel: Backward inclined wheels shall be single thickness plate type, designed for maximum efficiency and quiet operation, and shall be solid welded to the rim and back plate. Partial welding will not be acceptable on airfoil or backward inclined blades. All wheels shall be statically and dynamically balanced.

E. Shaft: Shafts shall be AISI 1040 or 1045 hot rolled steel, accurately turned, ground, polished, and ring gauged for accuracy. Shafts shall be sized for the first critical speed of at least 1.43 times the maximum speed.

F. Bearings: Bearings shall be heavy duty, grease lubricated, spherical roller or adapter mounted anti-friction ball, self-aligning, pillow block type and selected for a minimum average bearing life (AFBMA L-50) in excess of 200,000 hours at the maximum fan RPM.

G. Drive: Motor sheaves shall be cast iron, variable pitch on applications 10 HP and smaller, and fixed pitch on 15 HP and larger. Drives and belts shall be located external to the fan casing and rated for 150% of the required motor HP.

H. Finish and Coating: The entire fan assembly, excluding the shaft, shall be thoroughly degreased and deburred before application of a rust-preventative primer. After the fan is completely assembled, a finish coat of paint shall be applied to the entire assembly. The fan shaft shall be coated with a petroleum-based rust protectant.

I. Accessories: When specified, accessories such as belt guards, weather covers, access doors, companion flanges, variable inlet vanes, outlet dampers, piezometer ring airflow measurement device, inlet boxes, shaft coolers, shaft seals, inlet screens, etc., shall be provided by the fan manufacturer to maintain one source responsibility.

J. Cantilevered vane blades are to be used to minimize air performance insertion losses and noise. The operating mechanism shall be out of the inlet airstream.

K. Factory Balance and Run Testing: All fan wheels shall be statically and dynamically balanced in accordance with ANSI/AMCA 204 “Balance Quality and Vibration Levels for Fans” to Fan Application Category BV-3. This corresponds to a Balance Quality Grade G6.3. All assembled fans are test run at the rated operating speed or at the maximum RPM of the fan. Vibration readings are recorded in the horizontal, vertical and axial directions on both bearings. Trim balancing is performed if necessary to maintain BV-3 vibration limits. Records shall be maintained and a written copy shall be furnished.

2.4 ROOF MOUNTED SUPPLY FAN

A. General: Provide roof mounted supply fans each with a fan, fan housing, and weatherproof hood. Provide propeller, direct or belt driven power fans as scheduled on the drawings.

B. Housings: Provide aluminum weatherproof housings with welded structural steel frame.
1. Housing shall be arranged to facilitate access for servicing, and shall be factory finished.
2. Provide a square base to suit the roof curb.

C. Motors: Provide each fan with a squirrel-cage high efficiency induction motor conforming to NEMA MG 1.
1. Motors, including lubrication system for roof ventilators, shall be suitable for mounting with shaft vertical. Motors in the air-steam and direct drive motors shall be totally enclosed type.
2. Belt drives shall be rated for at least 150 percent of the motor nameplate power rating.
3. Each fan shall be provided with an unfused safety disconnect switch, mounted under the fan housing, adjacent to the motor. Thermal overload protection shall be provided in the operating electric disconnect switch located within the building.

D. Screens: Provide all discharge and exposed inlet openings with ½ inch by ½ inch wire-mesh, 16 gage aluminum or brass wire screen that is easily removable.

E. Prefabricated Curbs: Provide power roof ventilators with 12 inch high prefabricated curbs with 1½ inch insulation. Construct of galvanized steel or reinforced aluminum.

F. Dampers: Provide gravity-actuated or motor-operated dampers as indicated on the drawings in accordance with Sections 15890, “Sheet Metal Ductwork.”

G. Provide non-fused disconnect switch complete with factory wiring and mounting.

2.5 CABINET CENTRIFUGAL FANS

A. General: Provide direct drive centrifugal fans of quantities, sizes, arrangements and types as indicated on the drawings, as scheduled and specified.

B. Complete Fan Units: Provide factory designed, assembled, and tested fans, each consisting of a housing, fan wheel, shaft, bearings, structural supports, motor and accessories specified or scheduled.

C. Housings: Provide heavy gauge aluminum housings with external fasteners of stainless steel. All other parts shall be zinc plated and chromate treated steel to prevent corrosion.

D. Wheels: Provide single width, single inlet centrifugal wheels on all fans, as scheduled.
   1. Provide forward curved aluminum wheels.
   2. Statically and dynamically balance all wheels.

E. Motors: Provide each fan with an open drip-proof squirrel cage induction motor with ball or sleeve bearings, conforming to NEMA MG 1.

F. Provide non-fused disconnect switch complete with factory wiring and mounting.

PART 3 EXECUTION

3.1 INSTALLATION OF FANS

A. General: Install fans where indicated on the drawings in accordance with manufacturer's installation instructions.

B. Coordination: Coordinate fan work with work of roofing construction.

C. Ductwork: Connect ducts to ventilators in accordance with manufacturer's installation instructions and Section 15890, "Sheet Metal Ductwork."
   1. Provide access door in duct below fan to service damper.
   2. Solder bottom joints and up 2 inches of side joints of duct under roof ventilator to retain any moisture entering the fan.

D. Roof Curbs: Coordinate flashing and counter flashing of roof curbs with roofing system provided.

E. Start-Up: Verify rotation; adjust belts; lubricate and start-up in the presence of the manufacturer's representative.

3.2 INSTALLATION OF CABINET CENTRIFUGAL FANS

A. General: Install cabinet centrifugal fans in accordance with the manufacturer's installation instructions, where indicated on the drawings.

B. Isolation: Mount on vibration isolators specified.

C. Flexible Connections: Provide flexible connections.

D. Motor Connections: Provide flexible liquid tight motor connections.

E. Start-Up: Verify rotation; adjust belts, lubricate and start-up in presence of manufacturer's representative.

3.3 START-UP

A. Upon completion of installation of fans, verify rotation, lubricate bearings, adjust and balance the system and all associated air moving systems. Start-up and test equipment and controls to demonstrate capability and compliance with requirements. Field correct malfunctioning fans, then

retest to demonstrate compliance. These tests during and after installation and start-up shall not be considered as fulfilling requirements of commissioning tests.

B. Capacity Test: The fan system must be tested to deliver the specified capacity under the specified conditions as listed in the equipment schedule, on the drawings, or in the specifications. Requirements for air system test are specified in Division 15, Section 15990, "Testing, Adjusting, and Balancing."

C. Operational Tests: Demonstrate proper operation of fans and their controls.

END OF SECTION 15865

SECTION 15890
DUCTWORK

PART 1 - GENERAL

1.1 SUMMARY

A. Scope: Extent of ductwork is indicated on the drawings, in schedules, by requirements of this Section, and Section 15010, "Mechanical Basic Requirements."

B. Types: Types of ductwork systems required for this project include the following:
1. Rigid supply and exhaust ductwork.
2. Manual volume dampers.
3. Turning vanes.
4. Duct hardware.
5. Duct access doors.
6. Flexible connections.

C. Related Sections: Refer to other Division 15 sections for:
1. Testing, Adjusting and Balancing.
2. Registers and Grilles.
3. Fire Stopping Around Dampers and Openings.

1.2 QUALITY ASSURANCE

A. National Fire Protection Association (NFPA): Conform to NFPA 90A "Standards for the Installation of Air Conditioning and Ventilating Systems."

B. Sheet Metal and Air Conditioning Contractors' National Association, Inc. (SMACNA): Provide ductwork systems in conformance with "HVAC Duct Construction Standards - Metal and Flexible," latest edition.

C. Alternatives: The SMACNA standards and publications referenced in this Section of the specifications establish ductwork construction requirements.
1. Alternatives to these standards and publications may be submitted. Approval will be based on demonstration that such alternatives are equivalent and satisfy the functional requirements described in the referenced standards.
2. Such demonstration shall include evidence that the alternatives proposed were tested in accordance with SMACNA procedures and with test results certified by an independent testing laboratory.

1.3 SUBMITTALS

A. Division 1: Refer to Section 01300, "Submittals."

B. Certifications: Provide a duct schedule, certified by an officer of the sheet metal fabrication subcontractor, that the ductwork conforms to SMACNA standards, and for each sheet metal system furnished on the project include:
1. System name.
2. Duct material
3. Duct gauge.
4. SMACNA rectangular reinforcement number.
5. SMACNA intermediate reinforcement number.

6. SMACNA transverse reinforcement number.
7. Rod diameter and type.
8. Sealant type.
9. Attachment method.
10. Duct system design pressure.

C. Field Manual: Maintain a copy of the SMACNA "HVAC Duct Construction Standards-Metals and Flexible" on the project site.

1.4 MARKING AND STORAGE

A. Marking: Mark each section of ductwork delivered to the project site with a unique section number indicated on the shop drawings.

B. Storage: Store ductwork under roof. Ductwork stored outdoors and exposed to the weather shall be removed from the project site, cleaned or replaced with new.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Access doors shall be by Ruskin Manufacturing, Air Balance, Inc., Ventfabrics, Inc. or approved equal.

B. Volume dampers shall be by Ruskin Manufacturing, Air Balance, Inc. or approved equal.

C. Flexible connections shall be by Ventfabrics, Inc., The Flexaust Company, Duro Dyne Corporation, or approved equal.

D. Turning vanes shall be by Titus, Tuttle and Bailey, Carnes, Barber-Coleman, or Air Guide.

E. Duct hardware shall be by Ventfabrics, Inc. or Young Regulator Company.

2.2 MATERIALS

A. Sheet Metal: Unless otherwise specified or indicated, construct ductwork from sheet aluminum conforming to American Society for Testing and Materials (ASTM) B 209/B 209M, "Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate Alloy 3003, H14 temper; with mill finish.
1. Sheet steel is not permitted.
2. The use of duct board is not permitted.

B. Ductwork Sealants: Provide sealants with a maximum 25 flame spread, and maximum 50 smoke in the dry state, conforming to ASTM E 84, "Standard Test Method for Surface Burning Characteristics of Building Materials," and fire resistive and non-flammable in accordance with ASTM D 93, "Standard Test Methods for Flash Point by Pensky-Martens Closed Tester," when wet.

C. Duct Tape: The use of duct tape is not permitted.

2.3 FABRICATION

A. Shop Fabrication: Shop fabricate ductwork in conformance with SMACNA, "HVAC Duct Construction Standards-Metal and Flexible."

1. Conform to SMACNA requirements for metal thickness, reinforcing, joints, and sealing for maximum static pressures as follows:
    a. Construct supply ductwork for 2 inches H_2O positive static pressure.
    b. Construct exhaust ductwork for 2 inch H_2O negative static pressure.

B. Elbows: Conform to SMACNA and the following:
1. Provide long radius type with centerline radius minimum 1.5 by duct width.
2. Provide short radius or square elbows where indicated or where required to fit restricted spaces.
3. Provide vanes on all short radius elbows.
4. Provide double thickness turning vanes on square elbows.
5. Conform to SMACNA for the number of vanes for fittings.

C. Parallel Flow Branches: Provide long radius takeoffs at parallel flow branches or square elbows where indicated.

D. Branch Connections: Provide radius, 45 degree entry or conical taps.

E. Butt Taps: Butt taps are not permitted.

F. Offsets and Transitions: Conform to SMACNA.

G. Obstructions: Conform to SMACNA.

H. Duct Access Doors: Conform to SMACNA with piano hinges, two sash locks and door gaskets.
1. Screwed access panels are not permitted.

I. Volume Dampers: Provide volume dampers where indicated and construct as follows:
1. Provide single blades to a maximum of 10 inch blade width.
2. Provide inside end bearings and locking quadrants with wing nuts.
3. Friction locks are not permitted.
4. Break damper blades on both edges for stiffness.
5. Provide multi-blades on dampers 12 inches and larger with inside pins and bronze bearings, and 2 inch by 1/8 inch thick structural aluminum channel frame.
6. Provide galvanized connecting bar with bronze bearings on multi-blade dampers.

2.4 ACCESS DOORS

A. Standard: Provide access doors in conformance with SMACNA.

B. Location: Provide access doors in casings, plenums, and ducts where shown on the drawings and where specified for ready access to operating parts including fire dampers, valves, and concealed coils.

C. Pressure Clarification: Construct and install access doors in accordance with SMACNA Standards to suit the static pressure classifications and the locations where installed.

D. Access Doors in Ducts: Provide and size doors as follows:
1. Minimum 24 inches by 24 inches clear opening.
2. When field conditions require an access opening smaller than 16 inches by 12 inches, provide a 24 inches long removable section of casing or duct, secured with quick acting locking devices, 6 inches on centers, to permit ready access without dismantling other equipment.

E. Door Requirements: Provide doors in casings and duct as follows:
   1. Arrange doors so that system air pressure will assist closure and prevent opening when the system is in operation.
   2. Coordinate doors and equipment to provide unrestricted passage through clear door opening, without removal of any equipment.
   3. Where pressure regulating dampers are installed in ducts or plenums, provide access doors with a clear wire glass observation port, 6 inches by 6 inches minimum size. Anchor port with structural metal frame, resilient gaskets and stainless steel bolts.
   4. Hinges for doors in aluminum construction shall be brass with brass pins.

2.5 FLEXIBLE CONNECTIONS

A. Fans: Provide flexible connections between fans and ducts or casings where indicated on the drawings or required to accommodate expansion and vibration.

B. Material: Construct connections of cotton duck, minimum 325 ounces/in^2.

C. Length: Limit flexible connections to 4 inches active length in the direction of airflow.

D. Standard: Construct in accordance with SMACNA Standards.

E. Attachment: Attach to fans, casings and ductwork as hereinbefore specified.
   1. On fans with slip inlets and outlets provide hemmed, 1/16 inch connector sleeves screwed 8 inches on center.
   2. On fans with flanged inlet and outlet connections, provide structural companion flanges, bolted to 1/16 inch flexible connection sleeves, 6 inches on center.
   3. Provide sealant between flanges.

2.6 TURNING VANES

A. Fabricated Turning Vanes: Provide fabricated turning vanes and vane runners, constructed in accordance with SMACNA "HVAC Duct Construction Standards".

B. Manufactured Turning Vanes: Provide turning vanes constructed of 1-1/2" wide curved blades set at 3/4" o.c., supported with bars perpendicular to blades set at 2" o.c., and set into side strips suitable for mounting in ductwork.

2.7 DUCT HARDWARE

A. General: Provide duct hardware, manufactured by one manufacturer for all items on project, for the following:
   1. Test Holes: Provide in ductwork, at fan inlet and outlet, and elsewhere as indicated, duct test holes, consisting of slot and cover, for instrument tests.
   2. Quadrant Locks: Provide each damper quadrant lock device on one end of shaft and end bearing plate on the other end for damper lengths over 12". Provide extended quadrant locks and end extended bearing plates for externally insulated ductwork.

PART 3 EXECUTION

3.1 INSTALLATION

A. Cleaning: Clean and pretreat surfaces before application of sealant.
   1. Conform to the manufacturers cleaning procedures.

2. Install sealants in conformance with manufacturers' instructions.

B. Powder Actuated Fasteners: Powder actuated fasteners shall not be used to support rectangular ducts over 40 inches maximum dimension.

C. Hangers: Hangers and supports shall conform to SMACNA section, "Hangers and Supports." Nail inserts, hangers and supports to formwork before slabs are poured. Cut off or remove nails, strap-ends and other projections, flush with concrete after forms are removed.

D. Vertical Risers: Support vertical ducts, passing through floors with two continuous angles screwed to the duct and bearing to the floor and conforming to SMACNA, "Riser Support-From Floor." Blocking or shimming ducts will not be permitted.

E. Fire Separation: Vertical ducts or horizontal ductwork penetrating fire rated walls and floors shall be fire separated with UL listed and labeled fire dampers.
1. Provide fire dampers as indicated on the drawings.

F. Fittings: Provide fittings shown on approved shop drawings.
1. Offsets, transitions, remote coils, equipment, and field changes shall conform to SMACNA.
2. Butt taps and safing will not be permitted.
3. Bolt flanged equipment to ductwork with companion flanges.

G. Smoke Partitions: Penetrations of smoke stop partitions by ductwork or piping shall be thoroughly caulked using an intumescent firestop.

3.2 FIELD QUALITY CONTROL

A. Leak Test:
1. Provide test fans, orifices, temporary power and instrumentation in accordance with SMACNA testing specifications.
2. Perform leak tests in accordance with SMACNA standards and record data. If leak test falls within specified limits, then this portion of ductwork shall serve as a standard of quality for the remainder of the project.

B. Leakage: Leakage shall not exceed 5 percent of maximum system air quantity indicated in the schedules for new ductwork.

C. Testing and Balancing: Acceptance of duct systems shall be contingent upon conformance with the requirements specified in Section 15990, "Testing, Adjusting And Balancing."

3.3 ADUSTING AND CLEANING

A. Cleaning: Clean the inside of casings, fan scrolls, plenums and all ductwork (both new and existing) before starting fans.
1. Blowout coils with compressed air.
2. Install specified filters.
3. Proceed with testing and balancing.
4. Upon completion and acceptance of testing and balancing or after 200 hours operation whichever is greater, replace all filter media with new.

B. Set Dampers: Lock damper rods or splitter dampers.
1. Bend 2 inches from the bushing, and provide a 3 inch long handle.
2. Cut off balance of rod.
3. File or grind smooth.

END OF SECTION 15890

SECTION 15990
TESTING, ADJUSTING AND BALANCING

PART 1 - GENERAL

1.1 SUMMARY

A. Scope: Extent of testing, adjusting and balancing work required by this Section is indicated on the drawings, in schedules, and by the requirements of this Section, and Section 15010 "Mechanical Basic Requirements."

B. Systems: Testing, adjusting and balancing specified in this Section includes the following systems.
   1. Air handling systems including supply, return, outside air, and exhaust.

C. Related Sections: Refer to other Division 15 sections for:
   1. Fans
   2. Sheet Metal Ductwork

1.2 QUALITY ASSURANCE

A. Tester's Qualifications: The installer/modifier of the system to be tested is acceptable for the purposes of this test and balance. Duval County Schools will have a certified test and balance contractor come in after this test and balance is completed to verify the results.

B. Codes and Standards: Provide testing, adjusting and balancing conforming to American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE), American National Standards Institute (ANSI), and either NEBB or AABC the following:
   1. American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE): Comply with ASHRAE recommendations pertaining to measurements, instruments, and testing, adjusting, and balancing.
   2. NEBB or AABC: Comply with NEBB'S "Procedural Standards for Testing, Adjusting, Balancing of Environmental Systems" or comply with AABC MN-1 "National Standards," as applicable to mechanical air and hydronic Tester's Qualifications: The installer/modifier of the system to be tested is acceptable for the purposes of this test and balance. Duval County Schools will have a certified test and balance contractor come in after this test distribution systems, and associated equipment and apparatus.

C. Calibration of Testing Instruments: All measurement instruments used for testing, adjusting, balancing, and commissioning shall be calibrated. The time between the most recent calibration data and the final test report date shall not be over 3 years.

1.3 SUBMITTALS

A. Division 1: Conform to the requirements of Division 1, Section 01300, "Submittals."

B. Test Reports: Provide test reports which shall include identification and types of instruments used, and their most recent calibration date and calibration date. Include plans which cross reference each item tested and balanced with its location in the facility.

C. Maintenance Data: Include, in maintenance manuals, copies of certified test reports done by the school board’s test and balance company.

D. Substantial Completion: The contractor's test and balance and report as well as approval of the report by the engineer are required by, and a condition of, Substantial Completion of the project.

1.4 AGENDA

A. Agenda: A preliminary report and agenda shall be submitted and approved prior to the start of testing and balancing work.
   1. Review plans and specifications prior to installation of any of the affected systems, and submit a report indicating any deficiencies in the systems that would preclude the proper adjusting, balancing, and testing of the systems.
   2. The agenda shall include a general description of each air system with its associated equipment and operation cycles for heating, intermediate, and cooling.
   3. The agenda shall include a list of all air flow and air terminal measurements to be performed.
   4. The agenda shall also include specific test procedures and parameters for determining specified quantities (e.g. flow, drafts,) from the actual field measurements to establish compliance with contract requirements. Samples of forms showing application of procedures and calculations to typical systems shall be submitted.
   5. Specific test procedures for measuring air quantities at terminals shall specify type of instrument to be used, method of instrument application (by sketch) and factors for:
      a. Air terminal configuration.
      b. Flow direction (supply, return, outside air or exhaust).
      c. Velocity corrections.
      d. Effective area applicable to each size and type of air terminal.
      e. Density corrections.
   6. The agenda shall include identification and types of measurement instruments to be used, and their most recent calibration date.

1.5 JOB CONDITIONS

A. General: Do not proceed with testing, adjusting and balancing work until the following conditions have been met.
   1. Work has been completed and is operable. Ensure that there is no latent residual work yet to be completed on the tested equipment.
   2. Work scheduled for testing, adjusting and balancing is clean and free from debris, dirt and discarded building materials.
   3. All architectural openings (doors, windows, and other openings) which may affect the operation of the system to be tested, adjusted, and balanced shall at their normal states.
   4. All related mechanical systems which may affect the operation of the system to be tested, adjusted, and balanced shall be at their normal operating conditions.

PART 2 PRODUCTS

2.1 MANUFACTURERS (Not Used)

2.2 PATCHING MATERIALS

A. Material: Seal, patch and repair ductwork, piping and equipment drilled or cut for testing purposes.

1. Plastic plugs with retainers may be used to patch drilled holes in ductwork and housings.
2. Insulation shall be neatly hemmed with metal or plastic edging, leaving test points visible for future testing.

2.3 TEST INSTRUMENTS

A. Standards: Utilize instruments and equipment of type, precision, and capacity as recommended in the following standards:
   1. NEBB "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems."
   2. AABC Manual MN-1.

B. Test Instruments: All instruments used for measurements shall be accurate. Each test instrument shall be calibrated. If the school board's test and balance contractor determines that any system is more than 15% out of range, an instrument recalibration, or the use of other instruments and test methodology and a new test and balance will be required.

C. Additional Instruments: Permanently installed measuring instruments, such as temperature and pressure gauges, shall be checked against transfer standard instruments. Any instrument which does not meet specification requirement shall be replaced or recalibrated.

D. Cone Instruments: The Contractor shall employ manufactured enclosure type cones, capable of air volume direct readings, for all diffuser air flow measurements. The readout meters shall meet calibration requirements.

PART 3 EXECUTION

3.1 PROCEDURES AND INSTRUMENTS, GENERAL

A. Requirements: All systems and components thereof shall be adjusted to perform as required by drawings and specifications. Changes in pulleys, belts, sheeves, test cocks and like items shall be made at no additional cost to the owner.

B. Test Duration: Operating tests of heating and cooling coils, fans, and other equipment shall be of not less than four hours duration after stabilized operating conditions have been established. Capacities shall be based on temperatures and air and water quantities measured during such tests.

C. Instrumentation: Method of application of instrumentation shall be in accordance with the approved agenda.
   1. All instruments shall be applied in accordance with the manufacturer's certified instructions.
   2. All labor, instruments, and appliances required shall be furnished by the Contractor.

3.2 AIR SYSTEM PROCEDURES

A. Adjustments: Adjust all air handling systems to provide approximate design air quantity to or through, each component, and to maintain stable and comfortable interior temperatures, free of drafts or stagnant conditions. Adjusting and balancing of all systems shall be conducted during periods of the year approximating maximum seasonal operation.

B. Equalizers: Equalizing devices shall be adjusted to provide uniform velocity across the inlets (duct side for supply) of terminals prior to measuring flow rates.

C. Balance: Flow adjusting (volume control) devices shall be used to balance air quantities (i.e., proportion flow between various terminals comprising system) to the extent that their adjustments do not create objectionable air motion or sound (i.e., in excess of specified limits).
   1. Balancing between runs (submains, branch mains, and branches) generally shall be accomplished by flow regulating devices at, or in, the divided-flow fitting.
   2. Restriction imposed by flow regulating devices in or at terminals shall be minimal. Final measurements of air quality shall be made after the air terminal has been adjusted to provide the optimum air patterns of diffusion.

D. Fan Adjustment: Total air system quantities, generally, shall be varied by adjustment of fan speeds. Damper restriction of a system's total flow may be used only for systems with direct-connected fans (without adjustable pitch blades), provided system pressure is less than 1/2-inch W.G. and sound level is not objectionable.

E. Air Measurement:
   1. Except as specifically indicated herein, pitot tube traverses shall be made of each duct to measure air flow therein. Pitot tubes, associated instruments, traverses, and techniques shall conform to the ASHRAE "Handbook Fundamentals Inch Pound Edition."
   2. Where duct's design velocity and air quantity are both less than 1000 (fpm/cfm), air quantity may be determined by measurements at terminals served.

F. Test Holes: Test holes shall be in a straight duct, as far as possible downstream from elbows, bends, take-offs, and other turbulence generating devices, to optimize reliability of flow measurements.

G. Air Terminal Balancing: Generally, measurement of flow rates by means of velocity meters applied to individual terminals, with or without cones or other adapters, shall be used only for balancing. Measurement of air quantities at each type of air terminal (inlet and outlet) shall be determined by the method approved for the balancing agenda.

H. Air Motion: Air motion and distribution shall be as specified and indicated on drawings.

3.3 MECHANICAL CONTRACTOR'S REPORTS

A. Submittals: Three copies of the reports described herein, covering air and water system performance and air motion (fpm), shall be submitted prior to final tests and inspection.

B. Instrument Records: Types, serial numbers, and dates of calibration of all instruments shall be included.

C. Reports: Reports shall conspicuously identify items not conforming to contract requirements, or obvious maloperation and design deficiencies.

3.4 AIR SYSTEM DATA

A. Report: The mechancial contractor's report shall include for each air handling system the data listed below.
   1. Equipment (Fan or Factory Fabricated Station Unit):
      a. Installation data

1) Manufacturer and model
2) Size
3) Arrangement, discharge and class
4) Motor kW, voltage, phase, cycles, and full load amps
5) Location and local identification data

b. Design data
1) Data listed in schedules on drawings and specifications.

c. Fan recorded (test) data
1) CFM
2) Static pressure
3) rpm
4) Motor operating amps motor operating horsepower

2. Duct Systems:

a. Duct air quantities (maximum and minimum) - main, submains, branches, outdoor (outside) air, total air, and exhaust
1) Duct size(s)
2) Number of Pitot tube (pressure measurements)
3) Sum of velocity measurements (Note: Do not add pressure measurements)
4) Average velocity
5) Recorded (test) CFM
6) Design CFM

b. Individual air terminals
1) Terminal identification supply or exhaust, location and number designation
2) Type size, manufacturer and catalog identification applicable factor for application, velocity, area, etc., and designated area
3) Design and recorded velocities- fpm (state "core," "inlet," etc., as applicable)
4) Design and recorded quantities - CFM deflector vane or diffusion cone settings

3.5 FINAL TEST AND BALANCE, INSPECTIONS AND ACCEPTANCE

A. Scope: Final test and balance and certified reports shall be made by the school board's contractor to demonstrate that capacities and performance of air systems comply with contract requirements.

B. Retests: If these tests elicit a measured flow deviation of 15 percent or more from that recorded in the mechanical contractor's report listings, at 15 percent or more of the rechecked selections, the report shall be automatically rejected. In the event the report is rejected, all systems shall be readjusted and tested, new data recorded, new reports submitted, and new inspection tests made, all at no additional cost.

C. Marking of Settings: Following final acceptance of certified reports, the settings of all splitters, dampers, and other adjustment devices shall be permanently marked by the Contractor so that adjustment can be restored if disturbed at any time. Devices shall not be marked until after final acceptance.

END OF SECTION 15990

DIVISION 16

ELECTRICAL

SECTION 16000

ELECTRICAL WORK - GENERAL

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

A. In general, the work specified in this division of the specifications includes the furnishing of all labor, material, auxiliaries, and services necessary to install a complete and properly operating electrical systems, including all fees, charges, and permits necessary.

B. The Contractor shall furnish and install all wire, cables, conduits, wiring, wiring devices, lighting fixtures, motor controllers, safety switches, relays, control equipment, and all other apparatus and accessories indicated, specified, or required for complete lighting, power, control and instrumentation systems for the project facilities.

C. The Contractor shall refer to every section of these specifications for installation and coordination requirements applicable to the work specified in this division. The Contractor shall furnish and install all wiring and connections to all electrical equipment furnished under other sections of these specifications, except where specified or indicated otherwise.

D. The Contractor shall coordinate all electrical work with other project construction trades, installation requirements, sequence of construction schedule, etc., including coordination and installation of required conduit sleeves and supporting devices.

E. The Contractor shall be required to coordinate all electrical system connections with each appropriate utility company and shall furnish and install all equipment or material necessary to provide complete electrical and telephone service in accordance with all utility company requirements.

1.02 GENERAL REQUIREMENTS

A. Design drawings are diagrammatic and intended to show approximate installation and equipment locations. All dimensions shall be verified in the field and coordinated with shop drawings issued. Equipment schedules are intended to serve as a guide only and does not relieve the Contractor of the responsibility for the complete furnishing and installation of all wiring, cable, conduits, or additional apparatus required.

B. The Contractor shall furnish, install, maintain, and remove upon completion of the project, all temporary service required for construction and testing. The service shall be for general power and lighting and shall include distribution system, panelboards, grounding, branch circuits, general lighting, and receptacles as required.

C. The Contractor shall furnish and install reinforced concrete pads, for electrical equipment, of size as shown on the drawings or required. Unless noted otherwise, pads for indoor equipment shall be 4 inches high and exceed the equipment dimensions by 6 inches on all sides not flush to a wall; pads for outdoor equipment shall be a minimum of 12 inches thick and exceed the equipment dimensions by 2-1/2 feet on sides equipped

with door access and 6 inches on all remaining sides. Motor control centers, switchboards, etc., located indoors and equipped with a wireway at the base, shall be centered on a continuous reinforced concrete curb, minimum 6 inches high and 8 inches wide.

D. The Contractor shall furnish a covered, weather-protected facility, providing a clean, dry, non-corrosive environment for storage of all electrical and instrumentation equipment incorporated into this project in accordance with the provisions of the General Conditions.

E. The Contractor shall furnish and install a system of engraved, laminated nameplates (black lettering on a white background), designed to identify each major piece of equipment. Nameplates shall be attached with stainless steel removable fasteners.

F. Motors will be furnished with the equipment they drive unless indicated otherwise. Motors shall be high efficiency design. Motors located outdoors or within corrosive environments shall be severe duty construction.

1.03 SUBMITTALS

A. For each individual section of this division, there shall be submitted for approval a single, complete shop drawing submission. All elementary and schematic diagrams shall be provided with indication of system coordination and complete description of sequence of operation. Deviations from the contract documents shall be clearly identified.

B. Complete operation and maintenance instruction manuals, including system schematics which reflect "as-built" modifications, shall be provided. All wire terminations shall be numbered and identified on as-built drawings included as part of the operations and maintenance manuals. All drawings included within the operation and maintenance manuals shall be reduced to a maximum dimension of 17 inches x 11 inches, and shall be legible and reproducible. Special maintenance requirements particular to the system shall be clearly defined along with special calibration and test procedures.

C. One complete set of design drawings shall be neatly marked daily as a record of job progression and "as-built" installation. The drawings shall reflect the actual installed locations of all equipment and indicate the exact routing and elevations of all concealed conduits. Upon completion of the project, the drawings shall be coordinated with the as-built drawings and submitted to the Engineer.

D. The Contractor shall maintain a record of all construction documentation including construction survey data, inspection reports, test reports, startup logs, etc. Upon completion of the project, copies of all construction documentation shall be submitted to the engineer.

PART 2 PRODUCTS

2.01 MATERIALS

A. All material shall be new and shall conform with the standards of the Underwriter's Laboratories, Inc., American National Standards Institute, National Electrical Manufacturers' Association, Insulated Power Cable Engineers Association, and Institute

of Electrical and Electronic Engineers in every case where such a standard has been established for the particular type of materials in question.

B. The use of a manufacturer's tradename and catalog number is not intended to indicate preference but only the type and quality of the product desired. Products of reputable manufacturers of equal quality and functional type will be acceptable. Substitutes which tend to lower the quality of the work will not be permitted.

C. Acceptance of alternate equipment does not relieve the Contractor of the responsibility of compliance with the performance and accuracy requirements of these specifications. Where such substitutions alter the design or space requirements indicated on the Contract Drawings, detailed drawings shall be prepared and submitted by the Contractor delineating any changes in or additions to the work shown on the Contract Drawings, and such drawings and changes or additions to the work shall be made by the Contractor at no additional expense to the Owner. In all cases, the burden of proof that the material or equipment offered for substitution is equal in construction, efficiency, and service to that named on the Contract Drawings and in these Contract Documents shall rest on the Contractor and, unless the proof is satisfactory to the Engineer, the substitution will not be approved.

D. Wherever possible, equipment items having the same or similar rated capacity or function shall be identical.

E. All equipment and apparatus shall be the manufacturer’s latest proven design, neither presently scheduled for obsolescence nor developmental prototype.

F. All electrical apparatus and lighting equipment shall be in compliance with the Federal Energy Policy Act of 1992, including all subsequent updates, revisions, and replacements.

2.02 RACEWAYS

A. Metallic Conduit (Aluminum): All conduit shall be heavy wall rigid aluminum of standard pipe weight unless noted otherwise.

1. Couplings, conduit unions, conduit fittings, etc., shall be aluminum, shall have conventional trade dimensions, and shall be internally threaded with a tapered thread at each end to fit the tapered thread specified for the corresponding size conduit. Conduit outlet body covers shall be cast construction.

2. All conduits, couplings, and fittings, and all aluminum conduit elbows and risers located within the classified areas, or within concrete encasement, shall have a gray or black factory-applied PVC coating of not less than 20 mils thickness. Damaged PVC coatings shall be repaired with an approved compound. Conduit supports, channels, and mounting apparatus shall be aluminum or 316 stainless steel.

B. Flexible Conduit: All flexible conduit shall be Type UA liquid-tight flexible metal conduit made with aluminum flexible conduit covered with an extruded PVC jacket, unless noted otherwise. Fittings shall be the type specifically designed for flexible conduit use and shall form watertight connections. Flexible conduit fittings shall be aluminum construction.

1. Flexible conduit shall only be used for connections from conduits, junction boxes, or motor controllers to mechanical equipment or where the location of the connection is such that it is impractical to make a rigid conduit connection, where vibration isolation is required, or where specifically called for on the drawings. Flexible conduit shall be used for connection to all motors.

C. Non-Metallic Conduit: Non-metallic conduit, couplings, and fittings shall be Schedule 40 PVC unless noted otherwise. All PVC conduit joints shall be solvent-welded in accordance with the manufacturer's recommendations.

1. Underground conduits and conduit embedded within slabs on grade shall be non-metallic; however, conversion shall be made to rigid aluminum before conduit runs exit encasement. Conversion elbows, fittings and risers within the concrete encasement shall be PVC coated rigid aluminum conduit.

2. Underground conduits shall be installed not less than 24 inches below grade.

3. Underground conduits below driveways, and the underground segments of service entrance conduits, shall be encased in a minimum of 3 inches of concrete.

4. Underground pull boxes shall be provided for all miscellaneous underground conduit runs over 200 feet long.

5. A minimum 3-inch wide polyethylene warning tape, yellow for electrical and orange for telephone, with imprinted legend, shall be installed in the backfill above all underground conduits. Warning Tape shall be Allen Terra Tape, or equal and shall be guaranteed not to discolor. Unless indicated otherwise, the tape shall be 12 inches below the finished ground grade.

2.03 WIREWAYS

A. Wireways, as indicated on the drawings or approved for installation, shall be NEMA 12 construction with gasketed screw covers and gray baked enamel over a rust-inhibiting primer finish. Wireways installed outdoors on in corrosive atmospheres shall be NEMA 4X aluminum or 316 stainless steel.

1. Wireways shall be furnished and installed with required conduit knockouts only.

2.04 WIRES AND CABLE

A. Low Voltage Wire: Low voltage wire and cable shall be 600 volt, single-conductor copper, rated 90 degrees C dry and 75 degrees C wet. Unless indicated otherwise, low voltage building wire shall have XHHW-2 insulation.

B. VFD Cable: VFD power cables shall be shielded, flexible motor supply cable for variable speed drives subject to non-linear power distortions. VFD cable shall be used to interconnect AC variable frequency drives or control systems, to compatible AC motors. VFD cables shall be 1000V rated UL flexible motor supply cable, 3 stranded tinned copper circuit conductors with XLPE insulation, 1 stranded tinned copper ground wire with PVC insulation, overall combination tinned copper braid and foil shield, and black PVC jacket; Belden VFD cable, or equal.

1. VFD cables are subject to a harsh operating environment characterized by high voltage spikes, high noise levels and adverse environmental conditions. VFD cables shall be specifically designed to overcome the shortcomings of single conductor lead wire installed in conduit, unshielded tray cables, or continuously welded armored cable typically used for this application.

C. Instrumentation Cable: Instrumentation cable shall be single twisted pair, 600 volt, stranded, tinned copper conductors with cross-linked polyethylene primary insulation, overall foil shield with tinned copper braid, and chlorinated polyethylene jacket; Belden 3072F.

D. Inner Panel Wiring: Wiring for instrumentation and control panels shall be single conductor, 600 volt, 125 ℃ rated UL Type AWM stranded tinned copper conductors with cross-linked polyethylene insulation, Belden 356 series.

E. Profibus Cable: Profibus cable shall be type FC (Fast Connect) 2 wire shielded cable specifically designed for rapid installation, with flame retardant foam polyethylene insulation, foil/braid shield, and sunlight resistant PVC jacket; Siemens 6XV1830.

F. Fiber Optic Cable: Unless otherwise indicated or required to meet the specific installation requirements, fiber optic cables shall be OFNR-rated, all dielectric, tight buffered construction, consisting of tight buffered optical fibers with acrylate fiber coating, central strength member, aramid yarn strength member, ripcord, and PVC outer jacket. Optical fibers shall be minimum 50 micron core, 125 micron clad, 900 micron buffer glass fiber conductors. Fiber optic cables shall be Optical Cable Corporation Type OFNR, or equal.

1. Each individual cable fiber shall be ready for direct connector attachment.

2. Fiber optic cable termination interface patch panels shall be provided at all termination points.

3. Fiber optic connectors shall be field installable, low loss, mechanical connectors.

4. Each fiber optic cable system shall be provided with a complete fiber optic cable test kit including installation manual, hand held optical light source and power meter.

2.05 TERMINAL BLOCKS AND WIRE MARKING

A. Terminal blocks for power conductors shall be 600 volt, three pole unit construction type with high pressure solderless connectors, headless socket screws, and ampere rating equal to or greater than the ampacity of the maximum conductor size to be terminated; Square D Type LBC, or equal.

B. Terminal blocks for control and instrumentation conductors shall be 600 volt, sectional rail mounted terminal blocks with plastic pre-printed terminal numbering markers on both the inside and outside tracks, and provisions for center terminal bridge jumper cross connections with no loss of space on terminal or rail; Siemens 8WA1 011-1DF11, or equal. Terminal blocks for general control connections shall be feed-through terminal blocks; terminal blocks for instrumentation signal circuits shall be knife type test/disconnect terminal blocks; and terminal blocks for cable shield termination and grounding shall be ground blocks.

C. Wire numbers/letters shall be flattened polyolefin heat shrink markers for permanent wire and

2.06 BOXES

A. General: Boxes shall be installed at all locations necessary to facilitate proper installation and equipment connection, including each conduit/cable transition.

1. Minimum dimensions of boxes shall not be less than NEC requirements and shall be increased if necessary for practical reasons or where required to suit job condition.

2. Boxes shall have only the holes necessary to accommodate the conduits at point of installation. All boxes shall have lugs or ears to secure covers.

3. All boxes shall be rigidly secured in position. All boxes, except on unfinished ceilings and walls, and where conduit is run exposed, shall be so set that the front edge of box shall be flush with or recessed not more than 1/4-inch behind the finished wall or ceiling line.

B. Outlet Boxes: The location of outlets as shown on the drawings will be considered as approximate only. It shall be the work of this section to study all plans with relation to spaces surrounding each outlet in order that the work may fit and that when fixtures or other fittings are installed they shall be symmetrically located to best suit each condition. All outlets shall be coordinated with the work of other sections of these specifications to prevent outlets or fixtures from being covered by pipe, duct, etc.

1. Outlet boxes shall be cast one piece hub type standard gang boxes with rubber gaskets.

a. Wiring device boxes shall be equipped with cast screw-type covers; Crouse-Hinds Series FS or equal.

b. Fixture boxes shall be of sufficient diameter to provide a seat for the fixture canopy; Crouse-Hinds Series GRF or equal.

2. Unless indicated otherwise, receptacle boxes shall be centered 1 foot 6 inches; wall switch boxes shall be centered 4 feet; and wall fixture boxes shall be centered 7 feet 6 inches above finished floor.

a. Where shown at door locations, wall switch boxes shall be installed on lock side of door.

b. Where shown on columns or over doors, wall fixture boxes shall be installed symmetrically.

C. Pull Boxes: Pull boxes, including junction boxes and terminal boxes, shall be installed at all necessary points, whether indicated or not, to prevent injury to the insulation or other damage that might result from pulling resistance or other reasons during installation.

1. Unless indicated otherwise, pull boxes shall be NEMA 12 construction with gasketed screw covers and gray baked enamel over a rust-inhibiting primer finish. Pull boxes installed outdoors on in corrosive atmospheres shall be NEMA 4X aluminum or 316 stainless.

2. Pull boxes in excess of 36 inches x 36 inches x 12 inches shall be fabricated from code gauge aluminum or 316 stainless steel, suitably reinforced to provide a rigid, self-supporting construction. Each large pull box shall be equipped with a gasketed hinged cover fastened with screws on three sides. Dimension and installation details, for each large pull box, shall be approved prior to fabrication.

3. Pull boxes in hazardous areas shall be explosion proof, cast aluminum construction with hinged, threaded, screw-on covers. Explosion proof pull boxes shall be equipped with threaded conduit openings as required for the initial installation, all identified future connections, and a minimum of one spare conduit opening sized to match the largest otherwise required conduit opening.

4. Branch circuit pull boxes shall be appropriate outlet boxes with blank covers.

D. Underground Pull Boxes: Underground pull boxes shall be minimum 24-inch x 14-inch x 18-inch deep composolite service boxes constructed of reinforced polymer concrete suitable for light traffic loading, with locking cover and molded logo; Quazite Composolite, or equal.

1. Unless otherwise indicated underground pull boxes shall have solid bottoms. Where open bottom pull boxes are indicated or approved for installation, a bed of gravel, minimum 12" thick and exceeding the pull box footprint by 6" on all sides, shall be placed beneath each open bottom pull box.

2.07 WIRING DEVICES

A. Wall Switches: Wall switches shall be specification grade, totally-enclosed, toggle switches rated 20 ampere, 120/277 volt. Switches shall be single pole, double-pole, 3-way, or 4-way as indicated; GE-5951 through 5954, Hubbell 1221 through 1224, Leviton 1221 through 1224, or equal.

1. Wall switches shall be furnished with suitable plates. The material, colors, and finishes of switch plates shall be as directed to harmonize with the surroundings. In general, standard switches shall be brown with Sierra S-1N, Hubbell S-1N, or equal, 302 stainless steel plates.

2. Unless specified otherwise, wall switches installed outdoors or in corrosive atmospheres shall be weatherproof and vapor-tight. Weatherproof and vapor-tight switches shall consist of standard wall switches as previously specified, enclosed in Series FS condulets equipped with vapor-tight gasketed covers; Crouse-Hinds Series DS128, Appleton Series FSK-1VTS, or equal.

B. Receptacles: Receptacles shall be specification grade, grounding type, totally-enclosed, duplex receptacles rated 20 ampere, 125 volt; GE 8300-9, Hubbell 5362-GRY, Leviton 5362-GY, or equal.

1. Each receptacle shall be provided with a single gang plate for flush mounting. The materials, colors, and finishes of the plates shall be as directed to harmonize with the surroundings. In general, receptacles shall be gray with Hubbell

2. S-8N, Sierra S-8N, or equal, 302 stainless steel plates.

3. Unless specified otherwise, receptacles installed outdoors or in corrosive

atmospheres shall be weatherproof. Weatherproof receptacles shall each consist of standard duplex receptacles as previously specified, enclosed in Series FS condulet equipped with a weatherproof cover; Crouse-Hinds WLRD or equal. Outdoor receptacles installed on circuits without ground fault protection shall be type GFCI.

4. Special purpose outlets shall be black melamine locking receptacles with voltage, phase, and current ratings in accordance with the connected service and intended duty. Special purpose outlets shall be grounding type with permanent rating identification following installation; GE NEMA-Line, Hubbell Twist-Lock, Leviton Spec-Master, or equal, equipped with plates, boxes, etc., as indicated for standard receptacles.

5. The Contractor shall connect the grounding terminal in each receptacle to the inside of the metal enclosure.

2.08 PANELBOARDS

A. Lighting and power distribution panelboards shall be dead-front type equipped with main circuit breaker or main lugs only, as indicated on the drawings. Lighting panelboards shall be suitable for 120/208 volt, 3 phase, 4-wire, or 120/240 volt, 1 phase, 3-wire installation as indicated. Power distribution panelboards shall be suitable for 277/480 volt, 3 phase, 4-wire installation.

1. Panelboards shall be constructed with reinforced galvanized steel frames, sequence phasing, copper or tin-plated aluminum bus bars, code-gauge galvanized steel boxes with adequate wiring gutters, and code-gauge steel front panels with gray enamel finish over a rust-inhibitor. All connections shall be anti-turn solderless mechanical type and each panelboard shall be provided with a solid neutral bar. Front panels shall be provided with hinged doors equipped with semi-concealed hinges, directory card holder, and flush type combination catch and lock (all locks keyed alike with a minimum of 3 keys for each panel). Panelboard enclosures located outdoors or in corrosive atmospheres shall be 316 stainless steel or fiberglass NEMA 4X.

2. Main and branch breakers shall be bolt-on, quick-make, quick-break, thermal magnetic, molded case, trip-free type containing thermal inverse time delay and magnetic instantaneous over-current trip elements. Automatic tripping shall be indicated by the breaker handle assuming a clearly distinct mid-position. Branch breakers shall be interchangeable and shall be removable from the front of the panel without disturbing adjacent units. Multi-pole breakers shall incorporate internal trip bar and a single external handle.

3. Breakers supplying receptacles located in restrooms, locker rooms, shower rooms, etc., or outdoors, or weatherproof receptacles located indoors, shall be GFCI. Breakers supplying unswitched lighting circuits shall be rated SWD. Breakers supplying heating, air conditioning and refrigeration equipment shall be rated HACR.

4. Equipment ratings as indicated on the drawings shall be approximate. Panelboard and breaker ratings shall be coordinated with the installed service and the loads supplied. Unless indicated otherwise, breakers shall be rated not less than 10,000 amperes RMS symmetrical for 120/240 volts and 22,000 for 277/480 volts.

2.09 DRY TYPE TRANSFORMERS

A. Dry type transformers for general power and lighting shall be 2-winding, self-cooled, power transformers with ratings as indicated on the drawings. Unless indicated otherwise, transformers 3 KVA and above shall be provided with 4 fully rated taps, two 2-1/2% above and two 2-1/2% below rated primary voltage. Each unit shall be provided with a 220 degrees C insulation system incorporating a maximum 150 degrees C temperature rise above 40 degrees C ambient and shall be designed for continuous operation at rated KVA.

1. Transformer core shall be of high quality, cold-rolled, grain-oriented steel, annealed by the manufacturer for low loss and exciting current. Laminations shall be formed to eliminate burrs and annealed to reduce losses to a minimum. Winding conductors shall be annealed and insulated by the transformer manufacturer. Conductor surfaces shall be free from slivers, burrs, and other irregularities. Core and coil assembly shall be vacuum-impregnated for maximum resistance to moisture.

2. Enclosures shall be drip-proof and rodent-proof; all units installed outdoors shall be 316 stainless steel weatherproof construction.

3. All materials used in the transformers shall be flame-retardant and self-extinguishing and design shall incorporate vibration dampening systems.

4. Overload level, sound level, and BIL ratings shall meet or exceed NEMA and ANSI Standards.

2.10 DISCONNECT SWITCHES

A. Disconnect switches shall be 600 volt rated heavy-duty safety switches with full cover interlocks and quick-make, quick-break mechanisms. Switches shall be fused or non-fused, of capacities noted; General Electric Type TH or equal.

1. Unless indicated otherwise, switches shall have NEMA 4X aluminum or 316 stainless steel enclosures.

2.11 CIRCUIT BREAKERS

A. Circuit breakers shall be 600 volt thermal magnetic, quick-make, quick-break molded case air circuit breakers, with trip-free operation, incorporating an internal trip bar and a single external handle. Breaker ratings shall be coordinated with the installed service and loads supplied. Unless indicated otherwise, breakers shall be rated not less than 65,000 amperes RMS symmetrical.

1. Unless indicated otherwise, circuit breakers shall have NEMA 12 enclosures with gray baked enamel over a rust-inhibiting primer finish. Breakers located outdoors or in corrosive atmospheres shall have NEMA 4X aluminum or 316 stainless steel enclosures.

2. Circuit Breakers used as a service disconnecting device shall be 100% rated and UL service entrance rated; shall be equipped with long time, short-time, instantaneous and ground fault adjustments for system selectivity; and shall be fully rated for the maximum fault current, without the use of current limiters.

2.12 SUPPORT SYSTEMS

A. Groups of two or more conduits, and all boxes and equipment, shall be mounted on a system of minimum 1-5/8-inch x 1-5/8-inch heavy wall aluminum or 316 stainless steel channel with a minimum of 25% unused capacity.

B. Overhead conduits shall be supported on trapeze hangers from approved concrete inserts and shall be grouped with pipes wherever possible.

C. Support system hardware, including hanger rods, shall be aluminum or stainless steel.

2.13 LIGHTING FIXTURES

A. Lighting fixtures shall be of specification grade and listed or labeled by Underwriters Laboratories (UL) or an approved Nationally Recognized Testing Laboratory (NRTL).

B. LED fixtures shall comply with the following:

1. UL Standard 8750 “Light Emitting Diode Equipment for Use in Lighting Products”

2. IES Standard LM-79 “Electrical and Photometric Measurements of Solid-State Lighting Products”

3. IES Standard LM-80 “Measuring Lumen Maintenance of LED Light Sources”

4. IES Standard TM-21 “Projecting Long Term Lumen Maintenance of LED Light Sources”.

5. ANSI C78.377 “Specifications for the Chromaticity of Solid State Lighting Products” with LEDs binned within a maximum three-step MacAdam Ellipse to ensure color consistency amongst luminaries of the same type.

C. For LED fixtures, lamps, drivers, and components, provide a complete warranty for parts and labor for a minimum of five years from the date of Substantial Completion.

D. Provide only LED fixtures with a Design Lights Consortium (DLC) listing, a U.S. Department of Energy (DOE) “LED Lighting Facts” label, or a U.S. Environmental Protection Agency (EPA) ENERGY STAR label, which have demonstrated third-party testing verification.

E. Recessed lighting fixtures shall be thermally protected.

F. LED fixtures shall be modular and allow for separate replacement of LED lamps and drivers. User serviceable LED lamps and drivers shall be replaceable from the room side.

G. Dimmable LED fixtures shall have either a 0-10 volt, 3-wire dimming driver, or a two-step (50%-100%) line voltage, two switch controlled dimming driver, as shown on the drawings.

H. Unless otherwise indicated, LED lamps shall have a color temperature of 3500 degrees K, a CRI of 80 minimum, and a lumen maintenance L70 rating of 50,000 hours minimum.

I. LED drivers shall be electronic-type, labeled as compliant with radio frequency interference (RFI) requirements of FCC Title 47 Part 15, and comply with NEMA SSL 1 “Electronic Drivers for LED Devices, Arrays, or Systems”. LED drivers shall have a sound rating of “A”, have a minimum efficiency of 85%, and be rated for a THD of less than 20 percent at all input voltages.

J. Dimmable LED drivers shall be 0-10V type. Dimmable LED drivers shall be capable of dimming without LED strobing or flicker across their full dimming range.

K. Battery-backed LED emergency lighting fixtures shall consist of a normal LED fixture with some or all of the LEDs connected to a battery and charger. The battery shall be nickel cadmium and sized for a minimum of 90 minutes of fixture operation. The charger shall be solid-state and provide overload, short circuit, brownout and low battery voltage protection. The battery and charger shall include self-diagnostic and self-exercising circuitry to exercise and test itself for 5 minutes every month and for 30 minutes every 6 months. The fixture shall include a test/monitor module with LED status indicating lights mounted so as to be visible to the public. The fixture shall not contain an audible alarm.

L. Lighting contactors shall be electrically-operated, mechanically-held, suitable for panelboard mounting, and fully rated as indicated for tungsten and ballast lighting; Square D Type L and S, ASCO 917 and 920, or equal.

1. Contactors shall be provided with fused control circuits and 120 volt operating coils. Contactors shall be furnished with control power transformers where required.

2. Contactors shall be panelboard-mounted, or mounted in separate enclosures, as indicated. Contactor enclosures for interior locations shall be NEMA 1 code-gauge steel with gray baked enamel over a rust-inhibiting primer finish. Enclosures for exterior locations shall be NEMA 4 seam-welded aluminum. Enclosures located in corrosive atmospheres shall be type 316 stainless steel.

PART 3 EXECUTION

3.01 CODES, PERMITS, AND INSPECTIONS

A. The installations shall be in accordance with the regulations of the latest editions of the National Electrical Code, National Electrical Safety Code, applicable city, state, and local codes and regulations and other applicable codes, including utility company codes.

B. All permits required by state or local ordinances shall be obtained and after completion of the work, a certificate of final inspection and approval from the electrical inspector shall be furnished to the Owner. All permits for installation, inspections, connections, etc., shall be taken out and paid for as part of the work under this section.

3.02 CONDUIT

A. Conduit Installation: All conduits shall be run in such a manner as to cause the least interference with other trades. Conduits shall be joined by means of couplings or 3-piece coupling type conduit unions. Joints shall be set up tight. Runs shall be straight and true; elbows, offsets, and bends shall be uniform and symmetrical. Installation workmanship shall be of the best quality and skill.

B. Conduits shall be of sizes required to accommodate the number of conductors in accordance with the tables given in the current edition of National Electrical Code or as noted on the drawings. The minimum size of conduit shall be 3/4-inch.

C. Conduit runs shall terminate below the particular section of the motor control center or equipment to which their respective circuits run. Concealed conduits shall be run in as direct a line as possible. Exposed conduits shall be run parallel to or at right angles with the lines of the building. All bends shall be made with standard conduit ells, conduit bent to not less than the same radius, or malleable iron conduit outlet bodies with gasketed cast iron covers. Adjacent conduit runs shall be installed with concentric bends. All bends shall be free from dents or flattenings. Not more than the equivalent of four quarter bends shall be used in any one run between terminals at cabinets, outlets, and junction or pull boxes. Boxes shall be located in accessible locations.

D. Conduit shall be continuous from outlet to outlet and from outlets to cabinets, junctions, or pull boxes and shall enter and be secured to all boxes in such a manner that each system shall be electrically continuous from point of service to all outlets. Insulated grounding bushings shall be used on all metallic conduit. Terminals of all conduits shall be plugged with an approved cap to prevent the entrance of foreign materials when exposed during construction.

E. As far as practicable, all exposed conduits shall be run without traps. Where dips are unavoidable, a pull box or approved conduit outlet body shall be placed at each low point. Conduit systems shall be completed before conductors are drawn in. Where conduits must be run exposed, except as indicated in the drawings, locations of the runs shall be subject to approval.

F. Where exposed conduit needs clamping to the structures, clamps shall consist of galvanized malleable iron 1-hole pipe straps and pipe spacers, galvanized steel bolts of appropriate size to fill the holes in the straps and spacers, and approved expansion shields. Clamps used with aluminum conduit, and clamps located outdoors or in “corrosive atmospheres”, shall be PVC coated, aluminum or 316 stainless steel. Clamps shall be bolted to the structure or where necessary to intermediate galvanized steel brackets. Spacing between conduit supports shall not exceed the recommendations published by the National Electrical Code. No deformed, split, or otherwise defective conduit or fitting shall be installed. Conduit shall be installed with a minimum number of joints.

G. Where conduit has been cut in the field, it shall be cut square using a hand or power hacksaw or approved pipe cutter using cutting knives. The use of pipe cutters with cutterwheels will not be permitted. The cut ends of the field-cut conduit shall be reamed to remove burrs and sharp edges. Where threads have to be cut on conduit, the threads shall have the same effective length and shall have the same thread dimensions and taper as specified for factory-cut threads on conduit. Conduits installed in the work with threads not complying with these requirements shall be removed and replaced.

H. Where conduit installed in concrete or masonry extends across building joints, expansion joints with approved type grounding straps and clamps shall be installed. Expansion joints shall be Type XJ as manufactured by Crouse-Hinds, Appleton, or equal. Where conduit enters a building through the concrete foundation, below final grade, approved type FSK entrance seals shall be used.

I. All conduit shall be cleaned, prior to pulling in wire and cable, by pulling a stiff wire brush of the size of the conduit through it. This cleaning shall remove all foreign matter, including water, from the conduit. All boxes in which the conduit terminates shall be cleaned of all concrete, mortar, or other foreign matter and all threads in boxes shall be left clean and true upon completion of the work.

J. All spare, future, or telephone conduits shall be equipped with a pull wire prior to capping.

K. All conduits, fittings, and electrical equipment used within hazardous areas shall comply with requirements of the National Electrical Code for the type of hazardous location encountered, and shall be furnished as specified for "corrosive atmospheres".

1. In such hazardous locations, conduits terminating at boxes enclosing electric switching, or circuit opening equipment, shall be sealed at the entrance to the enclosure with approved, compound-filled, sealing fittings to prevent passage of explosive or combustible gases through the conduits.

2. All conduits exiting from such hazardous locations or entering said locations shall be similarly sealed at point of exit or entrance.

3.03 WIRE AND CABLE INSTALLATION

A. The installation of wires and cables includes all splicing of these wires and cables to each other and connecting them to receptacles, switches, control boxes, lighting fixtures, motors, and all other electrical apparatus installed under this Contract. All cable installation methods shall correspond to manufacturer's recommendations.

B. Wire and cable shall be suitably protected from weather or damage during storage and handling and it shall be first-class condition when installed.

C. The minimum size of wire or cable conductor shall be No. 12, unless indicated otherwise on the drawings. Wire sizes No. 8 and larger, and all wire sizes utilized for control or instrumentation, shall be stranded. All sizes called for in the specifications or shown on the drawings are American Wire Gauge sizes.

1. No wire smaller than No. 12 shall be used for any branch circuit unless noted otherwise on the drawings. Larger sizes shall be used where required or indicated on the drawings. If the single distance from the panelboard to the first device exceeds 50 feet, the minimum size for this run shall be No. 10 AWG with the minimum between devices as No. 12 AWG.

D. All sizes of wire and cable furnished and installed under these specifications shall be color-coded with a separate color for each phase and neutral used consistently throughout. Each conductor shall have factory color-coded insulation. As an alternative, wire sizes No.8 and larger shall have black insulation and shall be color-coded with waterproof phasing tape at each termination, junction box, pull box, etc. All 277/480 volt wiring shall be color-coded yellow, brown, and orange for hot legs (Phase A, B, and C, respectively). All 120/208-240 volt wiring shall be color-coded black, blue, and red for hot legs (Phase A, B, and C, respectively). The grounded neutral conductor of each circuit shall be color-coded white. Grounding conductors shall be color-coded green.

E. All wires and cables shall, as far as practicable in the judgment of the Engineer, be continuous from origin to destination without running splices in intermediate pull boxes, junction boxes, or wireways. At the ends of these wires and cables, only sufficient slack shall be left as may be required for making proper connections. There shall be no unnecessary slack.

F. In connecting wires and cables to apparatus, various methods shall be used depending upon the local conditions as detailed on the drawings. In general, solderless pressure connectors shall be used for terminals, taps, and splices for all wires and cables. Solderless pressure connectors or vinyl-covered steel spring-type connectors shall be securely fastened and shall not loosen under vibration or normal strain. All connections shall be in accordance with manufacturer's recommendations and shall be with connectors approved for the particular connection conditions.

G. Where wires and cables are connected to metallic surfaces, the coated surfaces of the metal shall be polished before installing the mechanical connector. The lacquer coating of the conduits shall be removed where a ground clamp is to be installed.

H. All soldered joints shall be made mechanically strong before soldering and shall be carefully soldered without the use of acid and shall be taped with insulating tape to a thickness equal to that of the insulation.

I. The installation of wires and cables shall include the furnishing and installing of all hangers, racks, cable cleats, and supports that may be necessary to make a neat and substantial wiring installation in all pull boxes, wireways, cable channels, and in such other locations as may be required. Plastic ties shall be used to hold the wires and cables together and to the racks or supports.

J. Each junction box, terminal box, control cabinet, or other terminal location containing a total of 4 or more conductor terminations or splices, shall be equipped with 1 or more terminal boards, as required, for connecting each wire including the spare wires. Each wire terminal shall be permanently marked throughout the entire system using, wherever possible, the notation of the wires given on the manufacturer's wiring diagrams. Sufficient terminal blocks shall be provided to terminate all wires routed to the enclosure including all spare conductors. In addition, the greater of 20 percent or four unused spare terminals shall be provided. All connections for future functions shall be wired to numbered terminal blocks, grouped separate from the terminal blocks in use. Terminal blocks shall be grouped to isolate power conductors from control conductors and to separate AC circuits from DC circuits.

K. Each control, instrumentation, and power cable and conductor shall be marked with the proper feeder symbol or termination number in each manhole, handhole, pull box, wireway, terminal cabinet, panelboard, switchboard and all additional locations required to provide positive identification. Each conductor shall be marked at each point of termination following final installation.

L. The electrical installation shall maintain suitable isolation between power, control and instrumentation conductors. Approved isolation barriers shall be provided within each pull box, terminal box, wireway, cable tray, handhole, manhole, etc.

3.04 TESTING

A. Upon completion, the Contractor shall provide all necessary instruments and special apparatus to thoroughly test the complete installation and shall conduct all tests that may be required to insure system is free of all improper grounds and short circuits, and that all the feeders are properly balanced. All electrical equipment shall be tested to determine proper polarity, phasing, relay settings, and operation. System shall be checked for quality and completeness in accordance with the provisions of the General Conditions. Any objectionable noise, heating, voltage drop, or excessive current draw, after in operation, shall be identified and corrected.

B. Prior to energization, the electrical system ground resistance shall be tested. Additionally, the insulation resistance of all electrical gear, power feeders, and electric motors shall be measured. Upon completion of all corrective measures required, certified acceptance reports, including tabulations of all initial and final resistance measurements, shall be submitted for approval in accordance with the provisions of the General Conditions.

C. Each motor starter overload element, and each motor circuit protector, shall be selected and adjusted to coordinate with the nameplate full-load current and service factor of the actual motors installed. Improper units shall be replaced. Upon completion of all corrective measures required, certified compliance reports, including tabulation of the actual full load current and voltage measurements for each phase of each motor, together with the nameplate current rating, overload element rating, and motor circuit protector setting, shall be submitted for approval in accordance with the provisions of the General Conditions.

D. System testing shall include complete thermal surveys of all electrical apparatus. Upon completion of all corrective measures required, certified acceptance reports, including satisfactory infrared photographs, shall be submitted for approval.

3.05 SPARE PARTS

A. The Contractor shall furnish, upon completion of the project, one year's supply of all consumable parts utilized within the electrical system, including pilot lights (minimum 12 of each type), fuses (minimum 12 of each type below 100 amps and 6 of each type 100 amps and above), recorder charts, ink tips, etc.

3.06 GUARANTEES

A. All materials and workmanship shall be guaranteed to be free from defects. Any part of the system considered defective by the Engineer within the guarantee period shall be immediately replaced or corrected to the Engineer's satisfaction without further expense to the Owner.

A. Upon final completion, the Contractor shall furnish certification from each equipment manufacturer that all equipment has been installed in accordance with the requirements of these specifications, is ready for permanent operation, and that nothing in the installation shall render the warranty null and void.

END OF SECTION

SECTION 16150

ELECTRIC MOTORS

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

A. In general, the work specified in this section of the specifications includes the furnishing of all labor, material, and services necessary for the installation and placing in operation of all electric motors indicated or required for the proper operation of all mechanical equipment installed.

1.02 SUBMITTALS

A. Motor manufacturers' product literature, nameplate data, and outline drawings shall be incorporated into the appropriate shop drawing submittals of all associated equipment. Additionally, manufacturers' test reports shall be provided for each motor.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

A. All electric motors shall be built in accordance with current NEMA, IEEE, ANSI, and AFBMA Standards where applicable. Each motor shall be of the type and quality described by these specifications and/or as indicated on the drawings, fully capable of performing in accordance with the manufacturer's nameplate rating and free from defective material and workmanship.

B. Electric motors shall be of sufficient capacity to operate the driven equipment, under all load and operating conditions, without exceeding 85% of the motor's nameplate horsepower rating with service factor, and without exceeding its rated temperature limits.

C. Electric motors for variable speed applications shall be designed for operation at the rated maximum speed and at reduced speeds throughout the variable range, without overloading. Each variable speed motor shall be compatible with all associated control equipment and operating conditions including increased electromagnetic noise (harmonics).

1. Each motor for variable speed operation shall be equipped with internal temperature detectors, in addition to all accessory equipment recommended by the variable speed equipment manufacturer.

2. Electric motors for variable frequency drive applications shall be inverter duty rated in accordance with NEMA MG1 Part 31, and shall be capable of being continuously pulsed at the motor terminals with a voltage of 1600 VAC.

D. All electric motors shall be suitable for continuous operation at maximum load and required starting duty, in a 40°C ambient temperature, at an altitude not to exceed 3,300', in a moist and corrosive atmosphere.

E. All motors shall be furnished with permanent, highly visible stainless steel nameplates. Nameplates shall include all motor ratings, special features, and accessories.

F. All motors shall be furnished with oversize main terminal boxes. Motor terminal boxes shall be gasketed and shall allow rotation to accommodate conduit entrance. Motor terminal boxes shall be equipped with grounding lugs.

G. All motors shall be equipped with lifting lugs. All motor enclosures shall be equipped with stainless steel screens for all openings in accordance with NEMA Standards for guarded construction.

H. Motor output shafts shall be suitable for connection as required.

I. Electric motors shall be manufactured by US Motors, or pre-approved equal.

2.02 SQUIRREL-CAGE INDUCTION MOTORS

A. General:

1. These specifications are intended to cover the functional requirements, features, and general construction of induction motors of the squirrel-cage, horizontal, vertical solid-shaft, vertical hollow-shaft, normal thrust, and high thrust type.

2. Each motor shall be IEEE-tested, NEMA-rated, premium efficiency energy-saving design, incorporating increased active electrical material and optimum electrical and mechanical design, to provide maximum operating efficiency and power factor. All motors shall meet or exceed EPACT efficiency requirements.

B. Rating:

1. When operated at nameplate voltage and frequency, squirrel-cage induction motors shall be rated normal or high starting torque, as required, low starting current not to exceed 600% full load current, low slip, 1.15 service factor, premium efficiency, and continuous duty at rated horsepower and rpm, with open drip-proof, weather-protected Type 1, totally-enclosed, fan-cooled, or explosion-proof construction, as indicated. Temperature rise shall be in accordance with NEMA Standards for the design employed.

2. Unless otherwise indicated, three phase squirrel-cage induction motors less than 50 HP shall be 200-230/460 volt, 3 phase, 60 hertz. Motors 50 HP and larger shall be 460 volt, 3 phase.

C. Electrical Characteristics:

1. Each motor shall be suitable for full voltage starting and non-injurious heating when operated on power systems with a variation in voltage of not more than ±10% nameplate rating and a variation in frequency of not more than ±5% nameplate rating.

2. Locked rotor torque shall be at least 125% full load torque at 100% rated voltage. Output torque shall exceed the maximum full load torque requirements of the driven equipment by at least 20% throughout the full operating range of the driven equipment, from start to full load. Locked rotor torque, breakdown torque, and

locked rotor currents shall be in accordance with NEMA Standards for the design employed.

3. Open drip-proof and WP-1 motors shall have a non-hydroscopic Class B insulation system treated with a minimum of 2 extra dips and bakes using 100% solid epoxy varnish.

4. TEFC and explosion-proof motors shall have a non-hydroscopic Class F insulation system and shall operate with a Class B temperature rise.

D. Mechanical Characteristics:

1. Motors, frames, and end shields shall be cast iron or heavy fabricated steel of such design and proportions as to hold all motor components rigidly in proper position and provide adequate protection for the type of enclosure employed. TEFC and explosion-proof motors shall be severe duty, all cast iron construction.

2. Windings shall be adequately insulated and securely braced to resist failure due to electrical stresses and vibrations. Winding and insulating materials shall consist of one or more of the following as dictated by the motor design: silicone rubber, polyester film, synthetic varnish, or glass cloth.

3. The shaft shall be made of high grade machine steel, or steel forging, of size and design adequate to withstand the load stresses normally encountered in motors of the particular rating. Bearing journals shall be ground and polished.

4. Rotors shall be made from high grade steel laminations adequately fastened together and to the shaft. Rotor squirrel-cage windings may be cast aluminum or bar type construction with brazed end rings.

5. Motors shall be equipped with vacuum degassed anti-friction bearings made to AFBMA Standards and be of ample capacity for the motor rating. The bearing housing shall be large enough to hold sufficient lubricant to minimize the need for frequent lubrication, but facilities shall be provided for adding new lubricant and draining out old lubricant without motor disassembly. The bearing housing shall have long, tight running fits, or rotating seals to protect against the entrance of foreign matter into the bearings or leakage of lubricant out of the bearing cavity. Thrust bearings shall be of ample capacity to carry the maximum thrust load of the driven equipment and the total weight of all revolving parts. Bearings of high thrust motors will be locked for momentary upthrust of 30% downthrust. All bearings shall have a minimum life rating of 5 years in accordance with AFBMA life and thrust values.

   a. For motor speeds 1800 rpm and below, double sealed bearings shall be used. The grease fitting shall be removed and a plug inserted so that the motor does not get inadvertently greased.

   b. For motor speeds above 1800 rpm, single shielded bearings shall be installed with the shields facing the outboard (grease supply) side and open on the inboard (stator) side. Zert fittings shall be installed at the 12 o'clock position when viewed axially. Grease escape valve or purge plug shall be installed at the 6 o'clock position.

c. The entry and exit paths for new and purged grease, respectively, shall enter and leave the bearing cavity on the outboard (shielded) side of the bearing (termed *conventional* grease flow design).

d. The motor manufacturer shall provide a procedure for initial greasing and for re-greasing the motor bearings. Specific intervals with a specified quantity of grease per the bearing manufacturer's recommendations are required.

E. Accessories:

1. Each motor shall be equipped with all necessary accessories as recommended by the manufacturer for the intended service.

2. Each motor shall be equipped with space heaters. Space heaters shall be low voltage, 120 volt, single phase, with the leads brought out to the motor conduit box.

3. Each motor shall be equipped with normally closed automatic reset thermostats imbedded in the stator winding, between phases, and connected in series. The two leads shall be brought to the motor conduit box.

PART 3 EXECUTION

3.01 GENERAL

A. Electric motors shall be supplied with the driven equipment, unless specified otherwise.

B. All fittings, bolts, nuts, and screws shall be plated to resist corrosion. Bolts and nuts shall have hex heads. All machined surfaces shall be coated with rust-inhibitor for easy disassembly.

C. The entire surface of each motor shall be treated with a final coating of chemical-resistant, corrosion- and fungus-protective epoxy enamel, over a red primer.

3.02 INSTALLATION

A. Motor Connections:

1. All motors shall be connected to the conduit system by means of a short section (18" minimum) of liquid tight flexible metallic conduit.

2. All motor feeders shall include a grounding conductor installed within the motor feeder conductor raceway, continuous from the motor starter to the motor conduit box. The motor feeder grounding conductors shall be properly terminated on each end with approved ground lugs and clamps.

3. Insulated mechanical polaris connectors shall be used for all motor feeder conductor connections to the motor leads. Connectors shall be UV rated, abrasion and chemical resistant, and specifically designed for the conductor material, stranding, etc.

3.03 TESTING

A. All motors shall be tested prior to shipment in accordance with the standard short commercial test procedures to include the following: no-load current, check-current balance, winding resistance, measure air gap, high potential, and bearing inspections.

B. Upon completion, the CONTRACTOR shall provide all necessary instruments and special apparatus to thoroughly test the complete installation and shall conduct all tests that may be required to insure system is free of all improper grounds and short circuits. All electrical equipment shall be tested to determine proper polarity, phasing, relay settings, and operation.

C. Prior to energization, the insulation resistance of each motor shall be tested in accordance with the motor manufacturer's recommendations. Upon completion of all corrective measures required, certified acceptance reports, including tabulations of all initial and final resistance measurements, shall be submitted for approval.

D. Each motor starter overload element, and each motor circuit protector, shall be selected and adjusted to coordinate with the nameplate full-load current and service factor of the actual motors installed. Improper units shall be replaced. Upon completion of all corrective measures required, certified compliance reports, including tabulation of the actual full load current and voltage measurements for each phase of each motor, together with the nameplate current rating, overload element rating, and motor circuit protector setting, shall be submitted for approval.

END OF SECTION

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 16400

ELECTRICAL APPARATUS

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

A. In general, the work specified in this section of the specifications includes the furnishing of all labor, material, and services necessary to install the following material, including all fees, charges, and permits necessary.

1.02 SYSTEM RESPONSIBILITY

A. All major components of the electrical system shall be the product of one manufacturer. To insure coordination, compatibility, and the maximum interchangeability of equipment items, the remaining components shall be provided by the major equipment manufacturer.

B. The manufacturer shall maintain a recognized engineering, servicing, and repair facility in the project locality.

1.03 1.03 SUBMITTALS

A. Complete wiring diagrams including coordination with instrumentation systems, generation systems, auxiliary control systems, etc., shall be approved prior to manufacture. Drawings shall be clear and carefully prepared to facilitate interconnections with other equipment. Standard drawings revised to indicate applicability shall not be acceptable.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

A. All factory wiring shall be permanently numbered every 12 inches.

B. In accordance with the JEA Approved Equipment Standards, the electrical apparatus shall be as manufactured by Cutler-Hammer.

C. The custom variable frequency drive equipment including harmonic filters shall be manufactured by a JEA approved Water and Sewer Standards “Pump Station Electrical and Control Panel” builder. All variable frequency drive equipment shall be native Profibus DP compliant and Profidrive PP04 compliant without the use of external adaptors, converters or gateways.

D. Alternate equipment that has been pre-qualified by the JEA, and is included within the JEA Approved Equipment Standards, shall be furnished complete with all accessory equipment, custom modifications, installation adjustments, etc., as required to meet the basis of design criteria, and at no additional cost to the JEA.

E. Auxiliaries, including fans, that are required for rated load operation at maximum ambient temperature, shall be 100 percent redundant.

F. Corrosion protection shall be provided for circuit boards and critical electrical components. Varnished or epoxy encapsulated circuit boards and tropicalized contactors suitable for corrosive environments shall be furnished where the VFDs are not located in climate controlled areas.

G. Electrical equipment construction and installation shall be provided as specified in the section of these specifications entitled ELECTRICAL WORK – GENERAL. Control components shall be provided as specified in the section of these specifications entitled INSTRUMENTATION AND CONTROL.

2.02 MOTOR CONTROL CENTERS

A. Unless indicated otherwise motor control centers (MCC) shall be NEMA Class II, Type B, provided in NEMA 12 enclosures with open bottom panels. Units located outdoors shall be NEMA 4X. Each lineup shall consist of vertical sections nominally 90" high, 20" deep, and 20" wide. Each lineup shall be equipped with 120/1/60 space heaters and shall be provided with starter units, feeder units, main breakers, transfer switches, transformers, panelboards, control equipment, etc., as indicated on the drawings.

B. Each vertical section shall be fabricated of code gauge steel, reinforced and bolted together to form a rigid, free-standing, completely enclosed assembly. Each section shall have a gray baked enamel final coat over a rust-inhibiting prime coat. Enclosure finish shall be suitably touched up, following installation, with a manufacturer's supplied spray. Unless approved otherwise, the final coat shall be ANSI 61 Light Gray.

C. Each vertical section shall be provided with a separate vertical wire trough door, a 12" horizontal wireway at the bottom, and a 6" horizontal wireway at the top. Each section shall have flange-formed covers on the rear and flange-formed doors with concealed hinges and quick release quarter-turn latches in the front. Unless approved otherwise, each vertical section shall be front-mounted only, completely front-accessible, and suitable for mounting against the wall. Each lineup shall be provided with continuous lifting angle and floor sills.

D. Power shall be distributed throughout the lineup by means of a 3-conductor, bolt-connected, edgewise-mounted, tin-plated copper bus bar system. Cable shall not be used on the load side of the main. Each lineup shall be provided with a continuous ground bus and, if indicated, a continuous neutral bus. Each bus shall be braced, and the entire motor control center rated, for the maximum available short-circuit fault current, minimum 42,000 amperes RMS symmetrical, unless indicated otherwise. The main horizontal bus shall be enclosed in an isolating compartment at the top of each vertical section. The main bus shall be rated as indicated on the drawings and shall not be rated less than 600 amperes. The vertical bus sections shall be sized for the total connected load and shall not be rated less than 300 amperes. The main horizontal bus, cable lugs, etc., and the full height of the vertical bus shall be isolated providing a complete, dead-front installation with glass-reinforced polyester barriers equipped with shutter mechanisms for stab openings. Each ground bus shall be rated for the total capacity of the lineup and shall not be rated less than 300 amperes. When provided,

each neutral bus shall have 50% of the full capacity of the main horizontal bus and shall be connected to the ground bus by a removable link.

E. A separate control power source, independent of any single control circuit, starter unit, etc., shall be provided for all control components (control relays, etc.), integral to multiple control circuits or system operations, or actuated by remote field devices. Where practical, all control components connected to the separate control power source shall be located in a common compartment.

F. Each unit compartment shall be provided with an individual front door, interlocked mechanically with the unit disconnect device to prevent opening the door with the unit energized, or energizing the unit with the door open. Unit disconnect device handles shall indicate the ON, OFF, TRIPPED, and RESET positions and shall be provided with means for padlocking in the OFF or ON positions. Each unit compartment, including door, shall be individually removable without disturbing adjacent units. Unless approved otherwise, all units shall be of drawout construction with a positive guidance system to insure positive stabbing into the vertical bus. Unit stabs shall be tin-plated copper. Each unit compartment shall be provided with a door-mounted engraved nameplate attached with removable fasteners.

G. Each motor starter unit shall be the combination type complete with molded case motor circuit protector; magnetic starter; manual resetting, 3-pole, bi-metallic thermal overload relay; individual 120 volt control power transformer; door-mounted pilot control devices, indicators, and instruments; and required accessory control relays, alternators, etc.

1. Each motor starter or contactor coil shall be equipped with a transient suppressor to limit high voltage transients.

2. Overload element ratings shall be individually selected and adjusted in the field to coordinate with the equipment connected.

3. Motor starters for submersible motors shall be equipped with ambient-compensated, bi-metallic, quick-trip type overloads.

4. Control power transformers shall be fused on both primary leads and one secondary lead with the remaining lead grounded and shall be sized for the entire control circuit, including motor space heaters and all additional remote auxiliary devices.

5. Motor circuit protectors shall be quick-make, quick-break, molded case air circuit breakers with adjustable instantaneous trip, rated not less than 22,000 amperes RMS symmetrical. Where additional capacity is required, motor circuit protectors shall be provided with current limiter attachments (fully coordinated to prevent single phasing) which increase rating to 100,000 amperes RMS symmetrical. Instantaneous trip settings shall be individually adjusted in the field to coordinate with the equipment connected.

6. Each unit shall be provided with 2-piece drawout terminal boards, for load and control terminals. The field terminal board component shall be mounted adjacent to the wiring trough.

7. As indicated on the drawings, starters shall be full voltage, across-the-line type, or reduced voltage autotransformer closed transition type, connected on the 65% tap,

unless noted otherwise. Starters shall be reversing or non-reversing as indicated.

8. Multi-speed starters shall have compelling relays which require starting at lowest speed, and prevent instantaneous transition between speeds.

9. Starter unit size and ratings shall be coordinated with the equipment supplied. Units of the same size shall be interchangeable.

10. In addition to contacts required, all starter units shall be provided with 2 spare N.O. and N.C. auxiliary contacts.

H. Solid-state reduced voltage motor starters shall consist of three sets of two inverse-parallel connected SCR's with a complete microprocessor based electronics package to provide soft start and smooth stepless acceleration to full speed. Unless otherwise indicated, or required by the application, each solid-state reduced voltage starter shall provide individually adjustable acceleration and deceleration control (0 - 120 seconds). Each starter shall be equipped with voltage transient protection (thermostat, MOV, and RC protection of each pole), shorted SCR protection, and single phase protection. Each starter shall be equipped with a 3 phase temperature-compensated solid-state motor overload protection relay. Each starter shall be fan-cooled and shall be rated 115% FLA continuous duty and 300% FLA for a minimum of 30 seconds. Each starter shall be equipped with a fault indication pilot light and auxiliary contact for remote indication of fault condition. Unless indicated otherwise, each solid-state motor starter shall include fully rated isolation contactor and bypass shorting contactor.

I. Feeder units shall be equipped with molded case air circuit breakers, unless indicated otherwise. Breakers shall be quick-make, quick-break, with trip-free operation, incorporating an internal trip bar and a single external handle. Breakers shall be thermal magnetic type rated not less than 25,000 amperes RMS symmetrical. Where additional capacity is required, feeder breakers shall be provided with current limiters (fully coordinated to prevent single phasing) which increase rating to 200,000 amperes RMS symmetrical. Breakers rated above 150 amperes shall be provided with interchangeable trips. Breakers shall be provided with control accessories, such as shunt trip, auxiliary contacts, etc., as indicated or required for proper interlocking and operation. Unless specified otherwise, main breakers shall be as specified for feeder breakers; however, main breakers shall be 100% rated, equipped with long time, short-time, instantaneous and ground fault adjustments for system selectivity; and shall be fully rated for the maximum fault current, without the use of current limiters

2.03 VARIABLE FREQUENCY DRIVES

A. Variable frequency drives shall control the speed of standard squirrel-cage induction motors by controlling the frequency applied to the motor. Each variable frequency drive shall convert incoming 60 hertz, 3 phase AC power to variable frequency AC by use of a 3 phase insulated gate bipolar transistor power module inverter with sine-coded pulse width modulated output. Each drive shall operate with a minimum of 0.98 primary power factor and a minimum efficiency rating of 0.96. Each drive shall have a continuous overload current rating of 110%, and 120% for 60 seconds.

B. Each drive shall be designed to operate from a local enclosure door mounted digital keypad, and from a remote automatic speed reference signal. Each drive shall be

contained within a gasketed, force-ventilated, free-standing motor control center style enclosure. Enclosures shall be equipped with replaceable filters. All factory wiring shall be permanently numbered every 12".

C. Each drive shall be equipped with input circuit breaker, output contactor, 3 phase temperature-compensated solid-state motor overload protection, and fault protection and indication as follows:

1. Softstall
2. Current limit
3. Overcurrent
4. Overvoltage
5. Short-circuit at load
6. Load-side ground fault
7. Undervoltage
8. Momentary power failure
9. Electronic thermal overload protection
10. Overtemperature
11. Overfrequency

D. Each drive shall be equipped with the following system interfaces:

1. Auxiliary dry contacts for indication of drive operation
2. Auxiliary dry contacts for indication of drive fault
3. Drive speed control input (4-20mA)
4. Drive speed report back output (4-20mA)
5. Digital diagnostic display for indication of drive diagnostic information
6. Profibus communications link to allow drive programming, monitoring, and control

E. Each drive shall provide independently adjustable acceleration (0.1-6000 seconds) and deceleration (0.1-6000 seconds) with choice of linear, S or C curves; adjustable starting frequency (0-10Hz) and maximum frequency (25-400Hz; adjustable voltage boost (0-300%); adjustable soft stall (10-150%); adjustable PWM carrier frequency (0.5-10KHz); and individually adjustable torque and current limits. All programmable parameters shall be adjustable from the door-mounted digital operator keypad.

F. Each drive shall be capable of PID set point control; a minimum of three critical frequency jump points with individual bandwidth; a minimum of eight digital inputs

selectable for drive enable, reset, forward/reverse direction, start/stop control, preset speed points, etc. ; and a minimum of three relay outputs selectable for run indication, fault, speed reach, low speed, etc.

G. Each drive shall automatically restart and resume normal operation following a power outage. Each drive shall have an adjustable retry function after a fault (1-10 attempts, 1-10 seconds).

H. Each variable speed drive to be controlled by a remote instrumentation signal shall be equipped with all necessary logic and control apparatus to provide the intended automatic mode of operation.

I. All VFDs shall be equipped with drive output line conditioning as required to protect the connected motors from reflected wave high voltage impulse, and shall submit documentation to demonstrate compliance.

J. All VFDs while operating at rated load shall limit harmonic distortion to no more than 5% for general systems during operation from the utility source and 10% for dedicated systems during operation from the standby generator source as defined by IEEE 519-1981. The VFD manufacturer shall provide harmonic filtering equipment required to meet this distortion limit and shall submit calculations to demonstrate compliance for drives operating from both sources.

2.04 AUTOMATIC TRANSFER SWITCHES

A. Delayed Transition, 3-pole, double throw type, rated 480 volts A.C. amperage to match service size as indicated on the drawings. Switch shall be electrically operated, mechanically held type switch and shall have Transient Voltage Surge Suppressor (TVSS) protection. Switch shall be equipped with full relay protection and shall transfer load to emergency source when one of more of the 3-phase voltage falls below 85 percent. It shall automatically return load to normal when all normal line voltages have been restored to 90 percent or more.

B. Automatic transfer switch shall be equipped with an engine starting contact and with an emergency lockout relay to prevent switch from closing load on emergency generator until proper voltage and frequency have been reached. Switch shall be equipped with one time delay, adjustable from 1/6 to 180 seconds in the engine starting contact circuit to prevent contact from closing until a predetermined delay has occurred. Switch shall be equipped with another time delay relay adjustable from 1/6 to 180 seconds which will, after a predetermined time, allow the emergency generator circuit to remain closed after normal power has been restored to at least 90 percent voltage. Switch shall be equipped with a time delay to run engine for 5 minutes at no load on retransfer to normal power source.

C. Provide the following dry contacts for remote monitoring:

1. ATS in Normal Position

2. ATS in Emergency Position

3. ATS Normal Source Available

4. ATS Emergency Source Available.

D. Brand: Transfer switch shall be Zenith Model ZTS-D/L, ASCO Series 4000 (with exception class IV stations shall be 7000 series with Bypass-isolation), Russelectric RTS-3 type delayed transfer switch with microprocessor controls.

1. Where an ASCO 7000 series is specified or equal, a two-way bypass-isolation switch shall provide manual bypass of the load to either source and permit isolation of the automatic transfer switch from all source and load power conductors. Bypass to the load-carrying source shall be accomplished with no interruption of power.

2. The bypass handle shall have three operating modes: “Bypass to Normal”, “Automatic”, and “Bypass to Emergency”. The “Open” mode shall completely isolate the automatic transfer switch from all source and load power conductors. When in the “Open” mode, it shall be possible to completely withdraw the automatic transfer switch for inspection or maintenance to conform to code requirement without removal of power conductors or the use of any tools. When the isolation switch is in the “Test” or “Open” mode, the bypass switch shall function as a manual transfer switch.

E. Enclosure: Transfer switch enclosures shall be available in UL NEMA 1, NEMA 3R and NEMA 3RX.

1. For exterior applications of the ATS a UL Type Secure NEMA 3RX (316 Grade Stainless Steel) enclosure of the secured type shall be provided. The control panel shall be housed inside of the cabinet on an inner full height door/panel away from vandalism and the corrosive environment. All electrical penetrations into the ATS shall be from the bottom of the enclosure. The outer weather tight full height secured door shall be constructed with a closed cell gasket door, a three-point pad lockable latch exterior door arrangement, and a continuous hinge the full height of the door.

2. Supplier shall provide strip heaters in all ATS enclosures.

F. Warranty: 5 years

2.05 POWER SYSTEMS STUDY

A. The Contractor shall furnish bound copies of a power system report which shall include the following:

1. Arc Flash Study in accordance with IEEE Standard 1584 and NFPA 70E. The study shall calculate the incident energy and flash protection boundary at all locations within the electrical distribution system (motor control centers, automatic transfer switches, panelboards, etc.).

2. Short Circuit Study, in accordance with ANSI C37.010-latest, should be performed to check the adequacy and to verify the correct application of circuit protective devices and other system components specified. The study shall address the case when the system is being powered from the normal source as well as from the on-site generating facilities. Minimum, as well as maximum, possible fault conditions shall be adequately covered in the study.

3. Protective Device Coordination Study, with coordination plots of key or limiting devices, plus tabulated data including ratings or settings selected. In the study, a

professional engineering balance shall be achieved between the competing objectives of protection and continuity of service for the system specified taking into account the basic factors of sensitivity, selectivity, and speed.

4. Motor Starting Study, for each large motor and for the largest motor served from each motor control center, to determine voltage dip or power inrush limitations at selected locations due to motor starting.

B. The Contractor shall warrant the exercise of professional competence in the performance of the specified studies to be provided by the major equipment manufacturer or a qualified expert. The Contractor shall obtain and verify all information necessary to perform the specified studies including utility company service data, generating equipment service data, motor data, existing equipment ratings, etc.

C. Upon completion, the Contractor shall provide written verification of final relay and trip settings as recommended by the system studies or otherwise approved.

D. The major equipment manufacturer shall provide machine printed 3.5 x 5 inch thermal transfer type labels of high adhesion polyester for each location identified in the arc flash study, for field installation by the Contractor.

PART 3 EXECUTION

3.01 SERVICE AND TRAINING

A. The major equipment manufacturer shall provide support and technical direction of installation, energization, and operation of the electrical equipment. Experienced field service engineering personnel shall be available at the job site, as needed, to provide the following factory service:

1. Recommended procedures for checks and tests.

2. Assist in solving erection problems by making critical checks and necessary adjustments.

3. Supervise necessary operational tests, verify, and document test results.

4. Perform final inspection of installed equipment.

5. Participate in initial energization.

6. Check and test all relays for proper operation. Contractor shall set relays as directed by the Engineer and shall submit a list of "as-left" settings.

7. Provide revised factory drawings on an "as-built" basis.

B. Upon completion, final approved as-built wiring diagrams shall be permanently fastened inside the enclosure doors of each MCC cubicle, VFD cubicle, etc. Wiring diagrams shall include all local and remote interconnections, in detail.

C. Prior to startup, the electrical apparatus equipment manufacturer and variable speed drive manufacturer shall conduct a complete training program (minimum 1 days

duration) at the job site for a minimum of 4 Owner-selected operating personnel. The training program shall include operation, preventive maintenance, and troubleshooting instructions relative to all aspects of each variable speed drive system provided.

1. Each manufacturer shall provide complete electrical apparatus and variable speed drive operation and maintenance manuals.

2. Each training program shall be scheduled a minimum of 14 days in advance. Proposed dates shall be submitted in writing for approval. The Owner may exercise the option to audio- or video-tape each entire training program without restriction.

D. The major equipment manufacturer shall provide a written, comprehensive, annually renewable service contract including all required or recommended maintenance service for a period of one year from the date of substantial completion. The contract shall specifically delineate all services rendered, equipment covered, and the annual renewal date.

END OF SECTION

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 16600

GROUNDING AND LIGHTNING PROTECTION

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

A. In general, the work specified in this section of the specifications includes the furnishing of all labor, material, and services necessary to install the following materials, including all fees, charges and permits necessary.

1.02 GENERAL REQUIREMENTS

A. The project's grounding system shall consist of a grounding electrode system in accordance with NEC specifications, bonded to a main ground bus interconnecting all power distribution equipment. Ground rods shall be located at each service connection, transformer pad, generator pad, outdoor electrical equipment pad, and as indicated or required, and shall be bonded to the main ground bus. Ground rod sections shall be coupled and driven to establish a maximum resistance to ground of 5 ohms throughout the grounding system.

1.03 LIGHTNING PROTECTION

A. The Contractor shall furnish and install a Master-Labeled lightning protection system in accordance with UL Master Label Code 96A, LPI Code 175, and NFPA Code 78 for each of the following areas:

1. Pump Station Electrical Building

B. Upon completion, a UL Master Label shall be furnished for each system.

1.04 SURGE PROTECTION

A. The Contractor shall furnish and install UL 1449 (latest edition) listed surge protection devices (SPD) for the protection of all AC electrical circuits from the effects of lightning-induced currents, substation switching transients, and internally-generated transients from inductive and/or capacitive load switching.

B. Each SPD unit shall be marked with a short circuit current rating and shall not be installed at a point on the system where the available fault current is in excess of that rating.

C. Complete UL 1449 performance ratings, including the fault current rating and VPR rating, shall be posted on the UL label of each SPD.

D. Submit copies of the UL Standard 1449 Listing documentation for each proposed SPD.

PART 2 PRODUCTS

2.01 GROUNDING

A. Ground rods shall be minimum 10 feet long, 3/4-inch diameter, copper-clad steel sections.

B. Main ground bus cable shall be minimum No. 4/0. Bonding jumpers shall be minimum No. 2. Unless noted otherwise, all grounding conductors shall be insulated and shall have green colored insulation.

C. All grounding hardware such as clamps, connectors, couplings, lugs, bolts, nuts, and washers shall be of silicone bronze.

2.02 LIGHTNING PROTECTION

A. All material furnished shall be copper or bronze UL-approved and labeled and of the size, weight, and construction to suit the application in accordance with UL and LPI code requirements and manufacturer's recommendations.

B. Air terminals shall be minimum 3/8-inch diameter copper bars extending a minimum of 10 inches above the object protected. Bases shall be cast bronze with bolt pressure cable connections and shall be securely mounted with stainless steel bolts or screws. Conductors shall be minimum 29 strand 17 gauge copper.

2.03 SURGE PROTECTION

A. AC power surge protection devices (SPD), formally transient voltage surge suppressors (TVSS), shall utilize heavy duty ‘large block’ MOVs, each exceeding 30mm diameter, with redundant modules per phase. SPD equipment shall provide suppression elements between all phases and each phase conductor and the system neutral. AC power surge protection equipment shall be APT, or equal.

B. SPD shall be UL labeled as Type 1, intended for use without need for external or supplemental overcurrent controls. Every suppression component of every mode, including N-G, shall be protected by internal overcurrent and thermal overtemperature controls. SPDs relying upon external or supplementary installed safety disconnectors do not meet the intent of this specification.

C. SPD shall be UL labeled with 200kA Short Circuit Current Rating (SCCR). Fuse ratings shall not be considered in lieu of demonstrated withstand testing of SPD, per NEC 285.6.

D. SPD shall be UL labeled with 20kA Inominal (I-n) for compliance to UL 96A Lightning Protection Master Label and NFPA 780.

E. Minimum surge current capability (single pulse rated) per phase shall be:

Service Entrance Equipment:	300kA
Power Distribution Equipment:	200kA
Panelboards & Control Panels:	100kA

F. SPD shall provide surge current paths for all modes of protection: L-N, L-G, and N-G for Wye systems; L-L, L-G in Delta and impedance grounded Wye systems.

G. UL 1449 Listed Voltage Protection Ratings (VPRs) shall not exceed the following:

System Voltage	L-N	L-G	L-L	N-G
208Y/120	700V	700V	1200V	700V
480Y/277	1200V	1200V	1800V	1200V

Numerically lower is allowed/preferred; old-style Suppressed Voltage Ratings (SVRs) shall not be submitted, nor evaluated due to outdated less-strenuous testing)

H. UL 1449 Listed Maximum Continuous Operating Voltage (MCOV):

System Voltage	Allowable Voltage Fluctuation (%)	MCOV
208Y/120	25%	150V
480Y/277	15%	320V

I. SPD shall have UL 1283 EMI/RFI filtering with minimum attenuation of -50dB at 100kHz.

J. SPD shall include visual LED diagnostics including a minimum of one green LED indicator per phase, and one red service LED. SPD shall include an audible alarm with on/off silence function and diagnostic test function (excluding branch).

K. Warranty – Each SPD shall have a warranty period of not less than 10 years, incorporating unlimited replacements of suppressor parts if they are destroyed by transients during the warranty period.

PART 3 EXECUTION

3.01 GROUNDING

A. The concrete-encased steel reinforcement within the foundation of each structure shall be grounded, with a minimum of one 20-foot ground rod, at each corner column and at intermediate columns at distances not to exceed 60 feet. The main ground bus shall be interconnected to each ground rod throughout the structural grounding system with a continuous bare copper cable loop, minimum No. 4/0, buried 30 inches below grade and 24 inches outside the structural footing.

B. A minimum of one 20-foot ground rod shall be located within each manhole and handhole. The main ground bus shall be interconnected to each ground rod throughout the underground ductbank system with a continuous bare copper cable, minimum No. 4/0, encased within the ductbank concrete envelope.

C. All grounding connections shall be made in the same manner as current carrying connections are made with bolted clamps and solderless connectors. All underground grounding system connections, cable-to-cable, cable-to-ground rod, etc., shall be made with exothermic-fused connections. Contact surfaces shall be equal in area to those of current carrying connectors. All contact surfaces shall be thoroughly cleaned before connections are made.

D. All ground connections shall be made with connectors or lugs approved for the specific type of connection.

E. Insulated-type grounding bushings shall be used for all metallic conduit terminations.

F. Permanent and effective ground connections shall be provided for transformer secondary neutrals.

G. The metallic frame of each motor, generator, transformer, panelboard, lighting fixture, outlet box, control equipment enclosure, etc. shall be grounded to the ground bus of the power distribution equipment with an insulated grounding conductor included in the feeder or branch circuit conduit.

H. The base of each street or area lighting standard shall be grounded to a ground rod driven into the ground near the base of the standard and to a separate ground wire run with the feeder. Ground rods shall be driven so that the top is 6 inches below finished ground grade. When the foundation is placed, a suitable ground wire shall be embedded in the concrete to facilitate connection to the base on the inside.

I. Installed ground cables shall be protected from subsequent mechanical damage. Sleeves shall be provided in foundation walls and in floors to facilitate installation of ground cables. Where ground cables enter buildings through sleeves, the sleeves shall be sealed with jute packing and approved sealing compound.

3.02 LIGHTNING PROTECTION

A. Air terminals, conductor cables, and downlead cables shall be located and spaced in accordance with UL and LPI requirements. Air terminals shall be located on every corner and along structure perimeters at distances not to exceed 20 feet. Downlead cables shall be installed at every corner column and at intermediate columns at distances not to exceed 100 feet. Minimum 3/4-inch Schedule 40 PVC conduits shall be embedded in each column as required for installation of downlead cables. Conductor cable fasteners shall be electrolytically compatible with the conductor and mounting surface and shall be installed not more than 3 feet apart on all conductors.

B. Metal bodies of conductance or inductance, including HVAC units, antennae, roof drains, plumbing vents, etc., shall be bonded to the lightning protection system.

C. The complete lightning protection system shall be bonded to the project's grounding system at each downlead cable. A minimum of three ground rods spaced 10 feet apart shall be bonded to the project's grounding system at each downlead cable connection.

D. Each area high mast lighting standard shall be equipped with a top-mounted lightning rod, downlead cable inside the pole, and base-mounted circuit surge protector.

E. Each low voltage panelboard shall be equipped with full service rated lightning arrestors ahead of the main.

3.03 SURGE PROTECTION

A. Service Entrance - Each SPD installed on service entrance equipment shall be replaceable modular construction. A UL approved disconnect switch shall be provided as a means of servicing disconnect if a 60A breaker is not available.

B. Power Distribution - Each SPD installed on switchboards or motor control centers shall be replaceable modular construction. Each SPD shall have an independent means of servicing disconnect such that the protected power distribution equipment remains energized. A 30A breaker (or larger) may serve this function.

C. Sub Panels - Each SPD installed on power distribution panelboards, lighting panelboards, control panels, unit equipment, etc. shall be encapsulated construction.

D. SPD equipment shall be installed per manufacturer's installation instructions with lead lengths as short (less than 24") and straight as possible. Gently twist conductors together.

E. Installer may reasonably rearrange breaker locations to ensure short & straightest possible leads to SPDs.

F. SPD shall be installed on the load side of the main service disconnect.

G. Before energizing, installer shall verify service and separately derived system Neutral to Ground bonding jumpers per NEC.

H. Status indication pilot lights for each TVSS shall be remote mounted and shall be visible from the front of the protected equipment enclosure.

END OF SECTION

PAGE INTENTIONALLY LEFT BLANK

SECTION 16900

INSTRUMENTATION AND CONTROLS

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

A. In general, the work specified in this section of the specifications includes the furnishing of all labor, material, and services necessary to install the instrumentation, control and monitoring systems, including all fees, charges, and permits necessary.

B. As specified in the section of these specifications entitled ELECTRICAL WORK - GENERAL, the Contractor shall furnish and install conduit, wiring, and connections for equipment and devices furnished under other sections of the specifications or under other contracts. The Contractor shall also install motor starters, switches, and other electrical equipment furnished under other sections or under other contracts.

C. The Contractor shall refer to the mechanical specifications and drawings for locations of pressure-operated control switches, float switches, solenoid-operated valves, limit switches, alarm actuating contacts, and other devices requiring wiring.

D. The Contractor shall make all interconnections required between transmitters, receivers, control panels, and miscellaneous devices, and shall provide for electrical supply to metering and signal systems.

E. All conduit and wiring between electrical and instrumentation panels, all field-mounted devices, and power sources shall be furnished and installed as required for a complete operable system.

F. Unless otherwise indicated, all electrical equipment and installation shall be in accordance with the section of these specifications entitled ELECTRICAL WORK - BASIC MATERIALS AND METHODS.

1.02 SYSTEM RESPONSIBILITY

A. To insure coordinated control systems, to properly achieve the indicated functions, and to provide a maximum interchangeability of equipment items and parts, the complete instrument and control system shall be furnished by a single instrumentation system contractor/supplier who shall be responsible for the satisfactory operation of the system.

B. The system contractor/supplier shall maintain permanent in-house system engineering and fabrication facilities including a quality assurance organization with the capability to perform complete system checkout and simulation in the shop prior to shipment.

C. The system contractor/supplier shall maintain a permanent field service engineer for maintenance service.

D. The system contractor/supplier shall perform all system engineering, prepare all necessary internal and external wiring and piping drawings, and assume full

responsibility with the performance requirements of these specifications, and as required for a complete and operable facility.

E. The instrumentation equipment locations and conduit drawings are diagrammatic to show the general scope and route of instrumentation system conduit. The instrumentation system contractor/supplier shall provide all conduit and wiring necessary for his specific requirements, in accordance with these specifications, and without additional cost to the JEA.

1.03 SUBMITTALS

A. The Contractor's attention is directed to the provisions of the GENERAL REQUIREMENTS with regard to submissions for approval. In order to facilitate review and approval of the proposed system, shop drawing submittals shall be made in two steps. The first submittal shall include all in-line devices such as flow meters, control valves, etc., to be supplied or coordinated with the instrumentation system. The second submittal shall include complete details of the instrumentation system.

B. Shop drawing submittals shall include the following:

1. Complete Bill of Materials, front panel view with component locations, subpanel view with component locations, and electrical schematics.

2. Functional description of the entire system including individual loop diagram descriptions.

3. Detail loop diagrams showing both piping and wiring requirements for each analog instrument loop in the system.

4. Component drawing for each component showing dimensions, mounting, and external connection details.

5. Detail layout, dimensions, fabrication, piping, and wiring schematic, connection, and interconnection drawings for each instrumentation panel, graphic display, termination cabinet, etc.

6. Component manufacturing data sheet for each component indicating pertinent data and identifying each component by item number and nomenclature as indicated on the drawings and in these specifications.

7. Testing plan description, sample test reports, and proposed testing schedule.

8. Training plan description, listing of training materials to be provided, and proposed training schedule.

C. Shop drawings shall conform to JEA standard drawing/schematics. References to the Bill of Materials shall be located for each component.

D. Operation and maintenance manuals, in accordance with the provisions of the GENERAL CONTRACT CONDITIONS, shall also be supplied. Operating instructions shall incorporate an updated functional description of the entire system including the system schematics that reflect as-built modifications. Special maintenance requirements

particular to the system shall be clearly defined along with special calibration and test procedures.

1. A complete set of "as-built" wiring, fabrication, and interconnection drawings shall be included with the manuals. In addition, an electronic copy of all drawings shall be submitted to JEA.

    a. Electronic drawing files shall be AutoCAD 2013 format.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

A. All of the equipment shall be the manufacturer's latest and proven design. Specifications and drawings call attention to certain features but do not purport to cover all details entering into the design of the instrumentation and control system. The completed system shall be compatible with the functions required and the equipment furnished by the Contractor and shall include all necessary control relays, contacts, and additional devices required for a complete, coordinated, operable facility.

B. Electrical control equipment, starters, contactors, etc., shall be full NEMA rated.

C. All contacts for control of electrically-operated equipment shall be rated not less than 10 amperes on 120 volts.

D. All electrical components of the instrumentation and control system shall operate on 120 volt, single phase, 60 hertz power, except as noted otherwise in the specifications. Control circuits for components which are located in hazardous areas shall be 24 volt intrinsically safe.

E. Where control equipment is not within sight of the motor, a safety lockout station with position indication, which shall prevent application of current to the motor, shall be located near the motor. Where the driven equipment is located on a different level than their driving motors, a safety lockout station shall be provided on each level.

F. Programmable controllers shall be utilized for standard relay and control functions within motor control centers, control panels, etc., only where specifically approved. In general, conventional control equipment shall be provided.

G. All controls for remote electrically-operated or motor-driven equipment shall be complete, including all necessary auxiliary relays so as to require only wiring and connections to the equipment control circuit. All contacts for control of remote motor-operated or electrically-operated equipment shall be rated not less than 10 amperes on 120 volts unless specified otherwise herein.

H. All remote motor-operated or electrically-operated equipment shall have a separate 120 volt control circuit, except as indicated otherwise.

I. All necessary fuses or switches required by the instrumentation manufacturer for his equipment shall be provided with the equipment. All instruments requiring an internal power supply shall have an internal ON-OFF switch.

J. The drawings and specifications indicate the energy sources that will be provided. Any other devices (isolation transformers, power supplies, lightning arresters, etc.) necessary to obtain proper operation and protection of the instrumentation system shall be furnished with the instrumentation system.

K. Individually adjustable alarm modules shall be provided to generate all required alarm or interlocking contacts from analog signals.

L. Signal isolators shall be provided for all analog signals to auxiliary equipment remote from instrumentation panels.

M. Signal isolators and analog alarm modules shall be individual self-contained units. Where multiple units are to be installed in the same location, a plug-in motherboard with minimum 25% spare capacity, master power supply, and individual plug-in function modules shall be provided.

N. All printed circuit boards throughout the instrumentation system shall have a protective coating to prevent corrosion.

O. All components shall be tagged with the item number and nomenclature given in the specifications and component tabulation lists.

P. Each field mounted transmitter shall be installed within a NEMA 12/3R aluminum or stainless steel enclosure for weather protection. Enclosures shall exceed the dimensions of the enclosed transmitter by a minimum of six inches on all sides and shall permit full unobstructed access to the enclosed transmitter. Enclosures shall be equipped with a continuous hinged access door with 3-point latching handle. Ventilation louvers shall be provided at top and bottom of both sides to promote convection cooling.

Q. Stainless steel spring-type terminals shall be used in all instrumentation and control panels; Wago TopJob S.rail mounted terminal blocks. All instrumentation and control panel control wiring shall terminate in ferrules.

2.02 CONTROL DEVICES

A. Control Stations - Control stations shall be heavy-duty, oil-tight, complete with NEMA 13 cast aluminum enclosures; Cutler-Hammer Type T, General Electric, or equal.

1. Safety lockout stations (SAFE-OFF) shall be equipped with 316 stainless steel padlock devices for padlocking in the de-energized position.

2. Unless specified otherwise, control stations installed outdoors, or in corrosive atmospheres, shall have watertight, NEMA 4X cast aluminum enclosures.

3. Control stations within hazardous locations shall be explosion-proof and shall have galvanized cast iron enclosures; Crouse-Hinds Type EFS, Appleton, or equal.

B. Pressure Switches - Where required for control system operation, adjustable deadband, industrial pressure switches shall be provided; United Electric Controls Model 2W3A, or pre-approved equal. Pressure switches shall be watertight (or explosion-proof as required), die-cast copper-free aluminum construction, with 316 stainless steel wetted

parts. Contacts shall be DPDT rated 5 amps at 120 VAC. Each pressure switch shall be equipped with a 316 stainless steel, adjustable, self-cleaning pulsation dampener.

C. Limit Switches (Leverless) - Where required for control system operation, magnetic target sensing, leverless limit switches shall be provided; GO Switch Model 81. Limit switches shall be NEMA 4X, hermetically sealed, 316 stainless steel construction. Limit switches shall be equipped with 72 inch potted leads. Unless otherwise required by the application and installation, limit switch outlet shall be located at the bottom of the enclosure. Limit switches shall not require input power for operation. Limit switch contacts shall be DPDT rated 10 amps at 120 VAC. Limit switches located in hazardous locations shall be explosion proof and intrinsically safe

D. Alarm Horns - Alarm horns shall be piezoelectric audible signal devices; Mallory Sonalert, or equal. Each alarm horn shall be equipped with an enable/disable control switch. Unless indicated otherwise, alarm horns shall be installed within the associated control equipment enclosure. Exterior alarm horns shall be weatherproof semi-flush mounted.

2.03 CONTROL COMPONENTS

A. General - Where indicated on the drawings, or required by the functions specified, control components shall be furnished and installed with-in control panels, motor control center, or other approved locations. Suitable nameplates shall be provided for all panel door or surface-mounted control devices. All component terminals, including auxiliary contacts, shall be wired to master terminal boards.

B. Pilot Devices - Selector switches, pushbuttons, indicating pilot lights, and additional pilot devices as required, shall be 600 volt rated heavy-duty, oil-tight, 30mm pilot devices as manufactured by General Electric, Cutler-Hammer, or equal.

1. Pushbuttons shall be standard type with anodized aluminum rings and colored buttons.

2. Selector switches shall be standard handle type with anodized aluminum rings and handles.

3. Pilot lights shall be full brightness LED type.

4. All pilot devices shall have appropriate nameplates and locking means for locking in the de-energized mode, and shall be color coded (red - start, on, open, up; green - stop, off, close, down; black - test, silence, miscellaneous).

C. Timers: Where required for control system operation, multifunction programmable timing modules shall be provided. Timers shall have timing modes and cycle times as indicated, shall be provided for operation at voltage indicated, and shall have DPDT contacts; Potter & Brumfield CNS-35-96, or equal.

D. Control Relays - Where required for control system operation, control relays shall be 3P3T, 11 pin octal type, with 10 amp contacts, internal LED, test button, and large ice cube style case; Cutler-Hammer D3PF3AA, D3PF3AT1, or equal.

1. Time delay relays shall be potentiometer adjustable time setting, 1.0% repeatability, 2PDT plug-in type time delay relays with, 10 amp contacts, 8-pin square sockets and hold-down springs. Delay on de-energize mode shall not require input power during the timing; Potter & Brumfield CK Series.

2.04 FIELD INSTRUMENTS

A. All field instruments shall be JEA latest standardized equipment as indicated on the drawings. Power and signal line surge protection shall be provided for each instrument signal. Each instrument shall include all mounting systems, fittings, etc. for a complete and proper installation in accordance with all manufacturer's requirements.

B. Liquid Ultrasonic Flow Meters:

1. Liquid ultrasonic flow meters shall use ultrasonic signals employing the transit time difference correlation principle to provide precise highly dynamic flow measurement with non-intrusive clamp-on technology.

2. The ultrasonic flow meters shall automatically switch between transit time and the Doppler-NoiseTrek ultrasonic measurement method when high particulate flows are encountered.

3. Flow velocity range for accurate measurement shall be 0.03 to 82 ft/s. Flow measurement repeatability shall be ±0.15% of reading. Flow measurement accuracy shall be ±0.5% of reading.

4. The ultrasonic flow transmitter power supply shall be 120/1/60. Power consumption shall be less than 16 watts, independent of meter size. Transmitter housing shall be NEMA 4X power coated aluminum, suitable for wall mounting. Transmitter display shall be 2x16 character dot matrix with backlight. Transmitter output shall be 4-20 mA linearly proportional to flow.

5. Each ultrasonic flow meter shall be furnished with a set of two ultrasonic flow transducers specifically selected by the manufacturer for the proposed installation. Flow transducers shall be NEMA 6P, type 316 stainless steel, with PEEK thermoplastic contact surface. Transducer cables shall be shielded, watertight, with sufficient length for direct connection to the flow transmitter, without junction boxes or extension cables.

6. Transducer mounting systems shall be consist of a type 316 stainless steel housing enclosing the transducer, mounted to the outside of the process pipe with type 316 stainless steel tension straps. The tension straps shall be equipped with integrated springs to compensate for process pipe diameter fluctuation caused by thermal expansion.

7. Each ultrasonic flow meter shall be provided with all accessories and mounting components required for proper installation and operation, including coupling compound.

8. The Instrumentation System Supplier shall field determine the optimum transducer mounting arrangement for each location and shall perform the final permanent transducer installations.

9. Ultrasonic flow meters shall have auto-zero and shall not require flow stoppage to set zero flow.

10. Ultrasonic flow meters shall match the JEA standardized equipment: Flexim Fluxus Type F704 transmitter, FSK/LC/OS/IP68 transducers, PLK-S/OS/IP68 transducer mounting fixtures.

2.05 INSTRUMENTATION AND CONTROL PANELS

A. All instrumentation and control panels shall be manufactured by a JEA approved Water and Sewer Standards “Pump Station Electrical and Control Panel Builder”. This requirement includes, but is not limited to, the following equipment:

1. Pump Station Control Panel
2. SCADA Radio Panel
3. VFD Panels

B. The Pump Station Electrical and Control Panel Builder shall engage the services of a JEA approved SCADA System Communications Contractor to furnish, install and commission the SCADA system antenna, including antenna, cable, mast and grounding.

1. Technical Field Service, Inc.

C. General - The general arrangement of each panel is shown on the drawings. No attempt has been made to detail the complete mechanical and electrical construction of the panels. The instrument schematic and electrical drawings indicate the overall system requirements.

1. Each panel shall be a gasketed NEMA 12 type enclosure, fabricated from minimum 11 gauge H.P.R. steel and adequately braced for rigidity and structural integrity. Panels shall incorporate front or rear access as indicated. Doors shall have hidden hinges, 3-point latches, and neoprene gaskets. All exterior welds shall be ground and sanded to a smooth finish. Steel shall be finished by bonderizing and painting with 2 coats of air-dry enamel. The inside of each panel shall be finished in white enamel with adequate lighting to permit proper servicing of components.

2. Each instrumentation panel shall be entirely pre-wired to master terminal blocks, so located as to allow easy access for termination of field wiring, and to allow removal of each component without disrupting operation of the remaining components.

a. Pre-wired control cables with multi-pin cable connectors shall be provided for all interconnections between individually assembled panel sections.

b. All necessary contacts for interlocking with the motor control center shall be dry-isolated contacts wired to the master terminal board.

c. Terminal blocks for analog signal conductors shall be equipped with knife switch disconnects to facilitate signal testing and calibration.

3. All instruments, display lamps, etc., shall be mounted on the panel fronts and wired to terminal blocks with identifying numbers. All wiring shall be neatly bundled with wire ties or in wireways and all wiring shall be identified by wire numbering. All external electrical connections shall be made to pressure type terminals at the

bottom of each panel section.

4. Each instrumentation panel shall be equipped with a main circuit breaker, incoming service transient voltage surge suppressor, and all required power protection equipment, including noise isolation control power transformer, for operation and protection of each integral component, from a single power supply, as indicated. Noise isolation transformers shall incorporate noise and spike/surge suppression in addition to an electrostatic shield to provide 60 dB/120 dB transverse/common-mode noise attenuation.

5. Each instrumentation panel shall be equipped with an uninterruptible power supply for complete power conditioning, isolation, and standby power.

6. A control circuit breaker of adequate size for the equipment within the panel shall be provided inside each panel section for disconnecting 115 volt control power. Fuses shall be provided in individual circuits as required for proper protection. Nameplates shall be provided for all instruments located on the panel front.

7. Wiring for all panels shall be Type XHHW, flame-retardant, cross-linked polymer, 600 volt rating, sized per National Electrical Code for load requirements. Wiring shall be run in conduit and all components mounted on steel subpanels mounted inside the panel. Wire identification in-side the panel shall be by wire numbering.

8. Relays, where practical, shall be of plug-in type with track-mounted PC board sockets. All field contacts shall be rated 10 amps.

9. Detail fabrication and wiring diagrams for all panels shall be submitted for approval by the Engineer prior to fabrication.

2.06 COMMUNICATION NETWORKS:

A. All Profibus installations shall comply with the Profibus User Organization. More information can be found at “www.Profibus.com”.

1. Reference “Profibus Design Guideline” order number 8.012.

2. Reference “Profibus Assembling Guideline” order number 8.022.

3. ALL recommendations from the Profibus User Organization must be followed, such as using fiber optic cable instead of copper when leaving a building.

4. Profibus cable shall be type FC (Fast Connect) 2 wire shielded cable specifically designed for rapid installation; Siemens 6XV1830.

5. Profibus connectors shall be made with metal housing and have Power, Transmit, Termination and Error indicating LED’s. Connectors shall be Brad Harrison MA9D00-42 and MA9D01-42 type or equal.

6. Only Diagnostic Repeaters shall be used where repeaters are required. Standard repeaters shall not be accepted. Repeaters shall be Siemens Diagnostic repeater 6ES7 972-0AB01-0XA0.

7. Provide an active termination resistor on the last device in the segment. Termination

resistor shall be Procentec 101-00211A.

8. For fiber optic communications use the Siemens OLM G12 Part # 6GK1503-3CB00.

B. All Ethernet installations shall comply with the Profinet User Organization. More information can be found at “WWW.Profinet.com”.

1. Reference “Profinet Installation Guideline for Cabling and Assembly” order number 8.072.

2. All recommendations from the Profinet User Organization must be followed such as using fiber optic cable when leaving a building.

3. Ethernet connectors shall be made with metal housing. Connectors shall be Siemens 6GK1901-1BB10-2AA0 type or equal.

4. All switches shall have the capability to be managed. Switches shall be of type Siemens Scalance X212-2 at minimum.

2.07 SUPERVISORY CONTROL SYSTEM

A. General - The supervisory control system (SCS) shall be a complete integrated system furnished and configured by the Instrumentation system contractor/supplier who shall be responsible for the satisfactory operation of the entire system. The SCS shall consist of programmable logic controllers, operator interface panels, and communications network.

1. The JEA shall provide all SCS system programming.

2. For all components furnished by the Instrumentation system contractor/supplier, the Instrumentation system contractor/supplier shall provide the JEA with all component data, calibration data, wiring diagrams, etc. that may be required to facilitate the proper development of the SCS.

3. System startup and testing shall be provided by the contractor, and shall be witnessed and approved by JEA.

B. General: Each programmable logic controller (PLC) shall be designed to provide monitoring and control in the form of relays, counters, timers, sequencers, etc., and shall consist of a processor unit, local and remote input/output units, power supplies, appropriate programming device, and all required peripherals, accessories, etc.

1. To ensure coordination, compatibility, and maximum interchangeability with the JEA's existing systems, the basis of design for control system PLCs shall be Siemens Simatic S7-300 Series programmable logic controllers.

2. The entire controller shall be suitable for installation and operation within harsh industrial environments, including 5-95% non-condensing humidity, 0-60°C temperature, vibration, shock, surges, etc., with-out fans, air conditioning, or electrical filtering.

3. Each controller shall be programmed in simple "ladder diagram" language and shall be easily programmed with a portable programming panel as system requirements change.

4. Unless indicated otherwise, prior to shipment, each PLC shall be loaded and tested at the Instrumentation system contractor/supplier manufacturing facility, and shall be witnessed and approved by JEA.

5. Programmable Logic Controller (PLC) - Each PLC shall be fully equipped to monitor all equipment status, alarm, and instrumentation system analog signals; control selected equipment operations; and seamlessly connect to the SCADA system network. Each PLC configuration shall be based upon the JEA standardized components as indicated on the drawings. Each PLC cabinet shall include a door mounted touch screen operator interface unit (Simatic TP1200).

PART 3 EXECUTION

3.01 SYSTEM DESCRIPTIONS

A. General - The general arrangement of the analog instrument and control system is shown on the drawings.

1. No attempt has been made to detail on the drawings all accessories and devices required for the complete system. The system contractor/supplier shall be responsible for the preparation of all detail installation drawings showing wiring, piping, mounting, etc.

2. The system contractor/supplier shall be responsible for furnishing all devices required for a complete functioning system.

3. All PLC operator “adjustable” or “selectable” settings shall be accessible from the PLC operator interface panel.

3.02 CONTROL PANELS:

A. Where indicated on the drawings, specified, or required by the functions specified, control panels, including all necessary accessories, shall be provided for control of the associated equipment.

B. Control panels shall be constructed in accordance with the requirements of Section 433 of the JEA Water & Sewer Standards, and shall be manufactured by a JEA approved manufacturer.

C. Control panels shall be constructed in accordance with UL 508A requirements for enclosed industrial control panels and shall bear the UL508A serialized label.

D. All components shall be mounted using stainless steel machine screws. All holes shall be drilled and tapped. The use of self-tapping screws is unacceptable.

3.03 ELECTRICAL TRANSIENT AND SURGE PROTECTION

A. All components of the instrumentation system shall be equipped with suitable surge arresting devices to protect the equipment from damage due to electrical transients, including lightning induced electrical power surges.

B. All power and signal circuits of each field instrument shall be protected with surge and transient protectors installed at both the source and destination ends of each circuit.

   1. Protectors for 120 volt power circuits shall be Citel DS41S-120.

   2. Protectors for signal circuits shall be Citel DLAW-24D3.

C. Surge and transient protectors shall be connected to the electrical system ground. Supplemental grounding shall be provided in accordance with the protection equipment manufacturer's recommendations.

3.04 FIELD CALIBRATION AND TRAINING

A. Prior to initiation of preliminary instrumentation system startup, the Contractor must submit a certified statement from his installation subcontractor confirming that all field wiring is complete, has been terminated and marked in accordance with the latest set of approved shop drawings, and has been tested for improper grounds, short circuits, and continuity.

B. The complete instrumentation system shall be systematically recalibrated and proper performance demonstrated in the presence of the JEA Representative and Engineer.

   1. Process calibration, such as volumetric drawdown tests on flow and level measurements, shall be conducted on all measuring systems as required by the JEA Representative.

   2. Performance demonstrations shall be provided individually for each complete instrumentation loop. Successful performance shall depend on proper performance of each and every component associated with the loop.

   3. The Contractor shall submit certified calibration and performance reports from his system contractor/supplier confirming that the entire instrumentation system is complete and operating properly.

C. All calibration, testing, demonstrations, training, etc., shall be at no additional cost to the JEA.

END OF SECTION

PAGE INTENTIONALLY LEFT BLANK