EAST WATER RECLAMATION FACILITY
SCREW PUMP REPLACEMENT

TECHNICAL SPECIFICATIONS

Project No. 03720-062-01

Owner:

CITY OF CLEARWATER
100 S. Myrtle Avenue
Clearwater, Florida 33756

Engineer:

JONES EDMUNDS & ASSOCIATES, INC.
324 S. Hyde Park Avenue, Suite 250
Tampa, Florida 33606

October 2023

CITY OF CLEARWATER
EAST WATER RECLAMATION FACILITY
SCREW PUMP REPLACEMENT
TECHNICAL SPECIFICATIONS

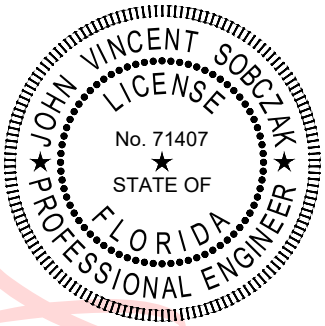
THIS ITEM HAS BEEN DIGITALLY SIGNED AND SEALED BY SEAN P. MENARD, PE ON THE DATE INDICATED.

PRINTED COPIES OF THIS DOCUMENT ARE NOT CONSIDERED SIGNED AND SEALED AND THE SIGNATURE MUST BE VERIFIED ON ANY ELECTRONIC COPIES.

Digitally signed by Sean P Menard
Date: 2023.10.26 08:13:41-04'00'

Sean P. Menard, PE, Florida Professional Engineer No. PE88647
This item has been digitally signed and sealed by Sean P. Menard, PE, on the date indicated here. Printed copies of this document are not considered signed and sealed. The signature must be verified on any electronic copies. The above-named Professional Engineer shall be responsible for the following Divisions in accordance with Rule 61G15-23.004, FAC:
Divisions 1, 2, 9, 11, and 15
Jones Edmunds & Associates, Inc.

Digitally signed by John Sobczak
Date: 2023.10.25 '15:45:59 -04'00

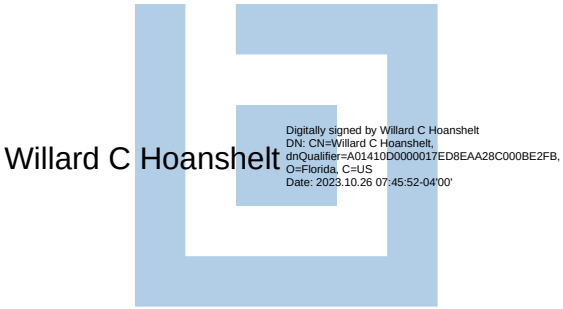


THIS ITEM HAS BEEN DIGITALLY SIGNED AND SEALED BY JOHN V. SOBCZAK, P.E. ON OCTOBER 25, 2023.

PRINTED COPIES OF THIS DOCUMENT ARE NOT CONSIDERED SIGNED AND SEALED AND THE SIGNATURE ON THE FIRST SHEET MUST BE VERIFIED ON ANY ELECTRONIC COPIES.

John V. Sobczak, PE, Florida Professional Engineer No. PE71407
This item has been digitally signed and sealed by John V. Sobczak, PE, on the date indicated here. Printed copies of this document are not considered signed and sealed. The signature must be verified on any electronic copies. The above-named Professional Engineer shall be responsible for the following Divisions in accordance with Rule 61G15-23.004, FAC:
Division 3
Wekiva Engineering, LLC

CITY OF CLEARWATER
EAST WATER RECLAMATION FACILITY
SCREW PUMP REPLACEMENT
TECHNICAL SPECIFICATIONS



Willard C. Hoanshelt, PE, Florida Professional Engineer No. PE42593
This item has been digitally signed and sealed by Willard C. Hoanshelt, PE, on the date indicated here. Printed copies of this document are not considered signed and sealed. The signature must be verified on any electronic copies. The above-named Professional Engineer shall be responsible for the following Divisions in accordance with Rule 61G15-23.004, FAC:
Division 16
EMI Consulting Specialties, Inc.

ENGINEER-PROVIDED TECHNICAL SPECIFICATIONS

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DIVISION 1

GENERAL REQUIREMENTS

SECTION 01000
PROJECT REQUIREMENTS

PART 1 GENERAL

1.01 SCOPE OF WORK

A. The Work to be done consists of the furnishing of all labor, materials, and equipment and the performance of all Work included in this Contract. The summary of the Work is presented in Section 01100, Summary of Work.

B. Work Included

1. The Contractor shall furnish all labor, superintendence, materials, plant power, light, heat, fuel, water, tools, appliances, equipment, supplies, and means of construction necessary for proper performance and completion of the Work. The Contractor shall obtain and pay for all necessary local building permits. The Contractor shall perform and complete the Work in the manner best calculated to promote rapid construction consistent with safety of life and property and to the satisfaction of the Engineer and in strict accordance with the Contract Documents. The Contractor shall clean up the Work and maintain it during and after construction, until accepted, and shall do all Work and pay all costs incidental thereto. The Contractor shall repair or restore all structures and property that may be damaged or disturbed during performance of the Work.
2. The cost of incidental work described in these Project Requirements for which there are no specific Contract Items shall be considered as part of the general cost of doing the Work and shall be included in the prices for the various Contract Items. No additional payment will be made therefor.
3. The Contractor shall provide and maintain such modern plant, tools, and equipment as may be necessary, in the opinion of the Engineer, to perform in a satisfactory and acceptable manner all the Work required by this Contract. Only equipment of established reputation and proven efficiency shall be used. The Contractor shall be solely responsible for the adequacy of his workmanship, materials, and equipment, prior approval of the Owner notwithstanding.

C. Public Utility Installations and Structures

1. Public utility installations and structures shall be understood to include all poles, tracks, pipes, wires, conduits, vaults, manholes, and all other appurtenances and facilities pertaining thereto whether owned or controlled by the Owner, other governmental bodies, or privately owned

by individuals, firms, or corporations used to serve the public with transportation, traffic control, gas, electricity, telephone, sewerage, drainage, water, or other public or private property which may be affected by the Work shall be deemed included hereunder.

a. The Contract Documents contain data relative to existing public utility installations and structures above and below the ground surface. These data are not guaranteed as to their completeness or accuracy and it is the responsibility of the Contractor to make his own investigations to inform himself fully of the character, condition, and extent of all such installations and structures as may be encountered and as may affect the construction operations.

b. The Contractor shall protect all public utility installations and structures from damage during the Work. Access across any buried public utility installation or structure shall be made to avoid any damage to these facilities. All required protective devices and construction shall be provided by the Contractor at his expense. All existing public utilities damaged by the Contractor shall be repaired by the Contractor, at his expense. No separate payment shall be made for such protection or repairs to public utility installations or structures.

c. Public utility installations or structures owned or controlled by the Owner or other governmental body which are shown on the Drawings to be removed, relocated, replaced, or rebuilt by the Contractor shall be considered as a part of the general cost of doing the Work and shall be included in the prices bid for the various Contract Items. No separate payment shall be made therefor.

d. Where public utility installations of structures owned or controlled by the Owner or other governmental body are encountered during the Work and are not indicated on the Drawings or in the Specifications, and when, in the opinion of the Engineer, removal, relocation, replacement, or rebuilding is necessary to complete the Work under this Contract, such Work shall be accomplished by the utility having jurisdiction, or such Work may be ordered, in writing by the Owner, for the Contractor to accomplish. If such work is accomplished by the utility having jurisdiction it will be carried out expeditiously, and the Contractor shall give full cooperation to permit the utility to complete the removal, relocation, replacement, or rebuilding as required. If such work is accomplished by the Contractor, it will be paid for as extra work as provided in the Agreement.

e. At all times in performance of the Work the Contractor shall employ acceptable methods and exercise reasonable care and skill so as to avoid unnecessary delay, injury, damage, or destruction of

public utility installations and structures and shall at all times in the performance of the Work avoid unnecessary interference with or interruption of public utility services and cooperate fully with the owners thereof to that end.

f. The Contractor shall give written notice to the Owner and other governmental utility departments and other owners of public utilities of the location of his proposed construction operations at least 48 hours in advance of breaking ground in any area or on any unit of the Work.

g. The maintenance, repair, removal, relocation, or rebuilding of public utility installations and structures, when accomplished by the Contractor as herein provided, shall be done by methods approved by the owners of such utilities.

1.02 DRAWINGS AND PROJECT MANUAL

A. Drawings: When obtaining data and information from the Drawings, figures shall be used in preference to scaled dimensions and large-scale drawings in preference to small-scale drawings.

B. Supplementary Drawings

1. When, in the opinion of the Engineer, it becomes necessary to explain more fully the Work to be done or to illustrate the Work further or to show any changes that may be required, the Engineer will prepare drawings known as Supplementary Drawings, with specifications pertaining to such Drawings, and the Contractor will be furnished one complete set of reproducible black-line prints (22 inches by 34 inches) and one reproducible copy of the specifications, or alternatively may be provided electronic files in PDF format, at the Contractor’s option.
2. The Supplementary Drawings shall be binding upon the Contractor with the same force as the Contract Drawings. Where such Supplementary Drawings require either less or more than the estimated quantities of Work, credit to the Owner or compensation therefor to the Contractor shall be subject to the terms of the Agreement.

C. Contractor to Check Drawings and Data

1. The Contractor shall verify all dimensions, quantities, and details shown on the Drawings, Supplementary Drawings, Schedules, Specifications, or other data received from the Owner, and shall notify the Engineer of all errors, omissions, conflicts, and discrepancies found therein. Failure to discover or correct errors, conflicts, or discrepancies shall not relieve the Contractor of full responsibility for unsatisfactory work, faulty

construction, or improper operation resulting therefrom, nor from rectifying such conditions at his own expense. He will not be allowed to take advantage of any errors or omissions, as full instructions will be furnished by the Owner should such errors or omissions be discovered.

2. All schedules are given for the convenience of the Engineer and the Contractor and are not guaranteed to be complete. The Contractor shall assume all responsibility for making estimates of the size, kind, and quantity of materials and equipment included in the Work to be done under the Contract.

D. Specifications: The Technical Specifications each consist of three parts: General, Products, and Execution. The General part of a Specification contains General Requirements that govern the Work. The Products and Execution parts modify and supplement the General Requirements by detailed requirements for the Work and shall always govern whenever there appears to be a conflict.

E. Intent

1. All Work called for in the Specifications applicable to this Contract, but not shown on the Drawings in their present form, or vice versa, shall be of like effect as if shown or mentioned in both. Work not specified in either the Drawings or in the Specifications but involved in carrying out their intent or in the complete and proper execution of the Work is required and shall be performed by the Contractor as though it were specifically delineated or described.
2. The apparent silence of the Specifications as to any detail or the apparent omission from them of a detailed description concerning any work to be done and materials to be furnished shall be regarded as meaning that only the best general practice is to prevail and that only material and workmanship of the best quality is to be used. The interpretation of these Specifications shall be made upon that basis.

1.03 MATERIALS AND EQUIPMENT

A. Manufacturer

1. All transactions with the manufacturers or subcontractors shall be through the Contractor unless the Contractor shall request and at the Engineer's option that the manufacturer or subcontractor deal directly with the Engineer. Any such transactions shall not in any way release the Contractor from his full responsibility under this Contract.
2. Any two or more pieces of material or equipment of the same kind, type, or classification, and being used for identical types of service, shall be made by the same manufacturer.

B. Delivery

1. The Contractor shall deliver materials in ample quantities to ensure the most speedy and uninterrupted progress of the Work to complete the Work within the allotted time.
2. The Contractor shall also coordinate deliveries to avoid delay in or impediment of the progress of the work of any related Contractor.

C. Tools and Accessories

1. Unless otherwise stated in the Contract Documents, the Contractor shall furnish each type, kind, or size of equipment one complete set of suitably marked high-grade special tools and appliances that may be needed to adjust, operate, maintain, or repair the equipment. Such tools and appliances shall be furnished in approved painted-steel cases, properly labeled, and equipped with good-grade cylinder locks and duplicate keys.
2. Spare parts shall be furnished as specified herein and as recommended by the manufacturer necessary for the operation of the equipment, not including materials required for routine maintenance.
3. Each piece of equipment shall be provided with a substantial nameplate, securely fastened in place, and clearly inscribed with the manufacturer's name, year of manufacture, serial number, weight, and principal rate data.

D. Service of Manufacturer's Engineer

1. The Contract Prices for equipment shall include the cost of furnishing a competent and experienced engineer or superintendent who shall represent the manufacturer and shall help the Contractor, when required, install, adjust, test, and place in operation the equipment in conformity with the Contract Documents.
2. After the equipment is placed in permanent operation by the Contractor, the engineer or superintendent shall make all adjustments and tests required by the Engineer to prove that the equipment is in proper and satisfactory operating condition and shall instruct such personnel as may be designated by the Owner in the proper operation and maintenance of such equipment.

1.04 INSPECTION AND TESTING

A. General

1. For tests specified to be made by the Contractor, the testing personnel shall make the necessary inspections and tests, and the reports thereof

shall be in such form as will facilitate checking to determine compliance with the Contract Documents. Electronic copies of the reports shall be submitted and authoritative certification thereof must be furnished to the Engineer as a prerequisite for the acceptance of any material or equipment.

2. If, in the making of any test of any material or equipment, the Engineer ascertains that the material or equipment does not comply with the Contract Documents, the Contractor will be notified thereof and he will be directed to refrain from delivering said material or equipment, or to remove it promptly from the site or from the Work and replace it with acceptable material without cost to the Owner.
3. Tests of electrical and mechanical equipment and appliances shall be conducted in accordance with the recognized test codes of the ANSI, ASME, or the IEEE, except as may otherwise be stated herein.
4. The Contractor shall be fully responsible for the proper operation of equipment during testing and instruction periods and shall neither have nor make any claim for damage that may occur to the equipment before the time when the Owner formally takes over the operation thereof.

B. Costs

1. The Contractor shall provide all inspection and testing of materials furnished under this Contract, unless otherwise expressly specified.
2. The Contractor shall bear the cost of shop and field tests of equipment and of certain other tests specifically called for in the Contract Documents, and such costs shall be deemed to be included in the Contract Price.
3. The Owner may test materials and equipment submitted by the Contractor as the equivalent to those specifically named in the Contract for compliance. The Contractor shall reimburse the Owner for the expenditures incurred in making such tests of materials and equipment that are rejected for non-compliance.

C. Certificate of Manufacture

1. The Contractor shall furnish the Engineer with authoritative evidence in the form of a certificate of manufacture that the materials to be used in the Work have been manufactured and tested in conformity with the Contract Documents.
2. These certificates shall be notarized and shall include copies of the results of physical tests and chemical analyses, where necessary, that have been made directly on the product or on similar products of the manufacturer.

D. Shop Tests

1. Each piece of equipment for which pressure, duty, capacity, rating, efficiency, performance, function, or special requirements are specified shall be tested in the shop of the maker in a manner that shall conclusively prove that its characteristics comply fully with the requirements of the Contract Documents.
2. Electronic copies of the manufacturer's actual test data and interpreted results thereof, accompanied by a certificate of authenticity sworn to by a responsible official of the manufacturing company and/or independent laboratory, shall be submitted to the Engineer for approval.
3. The Contractor shall bear the cost of shop tests and of furnishing manufacturer's preliminary and shop test data of operating equipment.

E. Start-up Tests

1. As soon as conditions permit, the Contractor shall furnish all labor, materials, and instruments and shall make start-up tests of equipment.
2. If the start-up tests disclose any equipment furnished under this Contract that does not comply with the requirements of the Contract Documents, the Contractor shall, before demonstration tests, make all changes, adjustments, and replacements required. The furnishing Contractor shall assist in the start-up tests as applicable.

F. Demonstration Tests

1. Before the Contractor's request for a Substantial Completion inspection, all equipment and piping installed under this Contract shall be subjected to demonstration tests as specified or required to prove compliance with the Contract Documents.
2. The Contractor shall furnish labor, fuel, energy, water, and all other materials, equipment, and instruments necessary for all demonstration tests at no additional cost to the Owner. The Contractor shall assist in the demonstration tests as applicable.

1.05 LINES AND GRADES

A. Grade

1. All Work under this Contract shall be constructed in accordance with the lines and grades shown on the Drawings or as given by the Engineer. The full responsibility for keeping alignment and grade shall rest upon the Contractor.

2. The Engineer will establish benchmarks and coordination points. Reference marks for lines and grades as the Work progresses will be located by the Contractor to cause as little inconvenience to the prosecution of the Work as possible. The Contractor shall place excavation and other materials so as to cause no inconvenience in the use of the reference marks provided. He shall remove any obstructions he places contrary to this provision.

B. Surveys

1. At his own expense, the Contractor shall furnish and maintain stakes and other such materials.
2. The Contractor shall check such reference marks by such means as he may deem necessary and, before using them, shall call the Engineer's attention to any inaccuracies.
3. At his own expense, the Contractor shall establish all working or construction lines and grades as required from the reference marks set by the Engineer and shall be solely responsible for the accuracy of these lines and grades. He shall, however, be subject to check and review by the Engineer.

C. Safeguarding Marks

1. The Contractor shall safeguard all points, stakes, grade marks, monuments, and benchmarks made or established on the Work; bear the cost of re-establishing them if disturbed; and bear the entire expense of rectifying Work improperly installed due to not maintaining or protecting or removing without authorization such established points, stakes, and marks.
2. The Contractor shall safeguard all existing and known property corners, monuments, and marks adjacent to but not related to the Work and shall bear the cost of re-establishing them if they are disturbed or destroyed.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01100
SUMMARY OF WORK

PART 1 GENERAL

1.01 SCOPE OF WORK

Unless otherwise expressly provided in the Contract Documents, the Work must be performed in accordance with best modern practice, with materials and workmanship of the highest quality to the satisfaction of the Owner.

A. The Project title is **East Water Reclamation Facility Screw Pump Replacement**.

B. The Specification divisions and Drawings are an integrated part of the Contract Documents and, as such, will not stand alone if used independently as individual sections, divisions, or drawing sheets. The Drawings and Specifications establish minimum scope of work and standards of quality for this project. They do not purport to cover all details entering into the design and construction of materials and equipment.

1.02 PROJECT DESCRIPTION

The work for this project generally includes but is not limited to the following:

A. Base Bids items generally including the following:

1. Replace three existing open screw pumps, grease pumps, motors, and appurtenances as required by the Contract Documents.
2. Refurbish the existing three slide gates located adjacent to the existing screw pumps as required by the Contract Documents.
3. Modify the existing electrical system including new electrical conduit, wire, starter panels; modify the existing motor control center; reconnect proposed signal wiring to the existing control panel and supervisory control and data acquisition (SCADA) system to match the existing; and other improvements to the screw pumps as required by the Contract Documents.
4. Provide coating systems as indicated in the Contract Documents and expansion joint and crack injection repair on the screw pump concrete structure.
5. Any other items indicated within the Contract Documents.

1.03 REFERENCE STANDARDS

Reference standards and recommended practices referred to herein shall be the latest revision of any such document in effect at the bid time. The following documents are a part of this Section. Where this Section differs from these documents, the requirements of this Section shall apply.

A. American Association of State Highway and Transportation Officials (AASHTO) Formerly (AASHO)
B. American Concrete Institute (ACI)
C. American Institute of Steel Construction (AISC)
D. American Iron and Steel Institute (AISI)
E. American National Standards Institute (ANSI)
F. American Standards Association (ASA)
G. American Society of Mechanical Engineers (ASME)
H. American Society of Testing and Material (ASTM)
I. American Water Works Association (AWWA)
J. American Welding Society (AWS)
K. Anti-Friction Bearing Manufacturer's Association (AFBMA)
L. Building Officials and Code Administrators International, Inc. (BOCA)
M. Construction Specifications Institute (CSI)
N. Federal Specification (FS)
O. Florida Department of Transportation (FDOT) Standard Specifications for Road and Bridge Construction, Latest English Edition (Standard Specifications)
P. FDOT Roadway and Traffic Design Standards Latest English Edition (FDOT Index)
Q. Geosynthetics Institute (GSI)
R. National Bureau of Standards (NBS)
S. National Electrical Manufacturer's Association (NEMA)
T. National Fire Protection Association (NFPA)
U. Portland Cement Association (PCA)
V. Occupational Safety and Health Act (Public Law 91-596), U.S. Department of Labor (OSHA)
W. Steel Structures Painting Council (SSPC)
X. Southern Standard Building Code (SSBC)
Y. Underwriters' Laboratories, Inc. (UL)
Z. United States of America Standards Institute (USASI)
AA. Regulations of Florida Industrial Commission Regarding Safety
BB. All local, state, county, or municipal building codes requirements of the Owner's Insurance

1.04 WARRANTIES

A. Warranties shall be in accordance with General Conditions, Supplementary Conditions, and Section 01780, Warranties and Bonds.

1.05 DELIVERY, STORAGE, AND HANDLING

A. The Contractor shall adhere to the requirements specified in Section 01650, Delivery, Storage, and Handling, for storing and protecting the items specified in this Section.

1.06 WORKING HOURS

A. Work under this contract shall not be prosecuted on Saturdays, Sundays, or on State and/or National holidays, except in time of emergency, and then only under written permission from the Owner who shall be the sole judge as to the urgency of that situation. On weekdays, the workday shall be limited to daylight hours and in accordance with Community Development Code.

B. If the Contractor deems it necessary to work on Saturdays, Sundays, holidays, or beyond daylight hours to comply with his construction schedule or because of an emergency, the Contractor shall request permission of the Owner to do so. If, in the opinion of the Owner, the need is bona fide, the Owner will authorize the Contractor to work such hours as may be necessary. The Contractor shall adhere to noise restrictions from 6:00 p.m. to 7:00 a.m. any day and all day Sunday according to the Community Development Code, Section 3-1508.

1.07 REIMBURSEMENT FEES

A. The Contractor shall reimburse the Owner for the charges of the Engineer and Engineer’s Consultants as a result of the following actions:

1. Services due to Contractor's working beyond regular working hours as defined in the General Requirements.
2. Evaluation of substitutions.
3. Costs generated as a result of more than two submittals of any one Shop Drawing or Sample being required for evaluation due to rejection for noncompliance of the original submittal or for lack of information required by the Contract Documents.
4. Additional field observations, engineering analysis, correspondence, meetings, or other work due to non-complying or defective construction, materials, or equipment performed or furnished by the Contractor, Subcontractors, or Suppliers.
5. All costs due to work not being ready for tests and/or inspections when the Contractor has notified Engineer that work is ready for tests and/or inspections. The Contractor shall reimburse the Owner for all failed tests and subsequent retests. Partial payments payable to Contractor shall be

distributed, first to reimburse the Owner for such charges, with the balance distributed to the Contractor in accordance with the Contract Documents.

B. The Owner's reimbursement for the charges shall be a deduction from the Contractor's partial payment(s).

C. The following rates shall be applied as the Owner's reimbursement of the Engineer's fee to be paid by the Contractor for expenses defined above.

1.	Senior Field Representative (Construction):	$ 90.00/hour
2.	Senior Construction Administrator:	$100.00/hour
3.	Engineering Consultant (Senior Project Manager):	$170.00/hour
4.	Administrative Assistant:	$ 60.00/hour

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01200
MEASUREMENT AND PAYMENT

PART 1 GENERAL

1.01 SCOPE OF WORK

A. This Section covers methods of measurement and payment for items of work under this Contract.

B. The total Contract Price shall cover all work required by the Contract Documents. All cost in connection with the proper and successful completion of the work including furnishing all materials, equipment, and tools and performing all necessary labor and supervision to fully complete the work, shall be included in the unit price and lump-sum Bid prices. All work not specifically set forth as a pay item in the Bid Form or Bid Schedule shall be considered a subsidiary/ ancillary obligation of the Contractor and all costs in connection with these subsidiary/ancillary obligations shall be included in the Bid(s) to provide a complete and functional Project.

1.02 EXCAVATION, TRENCHING, AND CLEARING

A. Except where otherwise specified, the unit price or lump-sum price bid for each item of work which involves excavation, trenching, clearing, grubbing, or disposal of cleared and grubbed materials shall include all costs for such work. No direct payment shall be made for clearing, grubbing, disposal of cleared or grubbed materials, excavation, trenching, disposal of surplus excavated material, handling water (and groundwater), and purchasing and hauling of required fill material. All excavation and trenching shall be unclassified as to materials which may be encountered; in addition, trenches shall be unclassified as to depth, unless otherwise stated.

1.03 LUMP SUM

A. For lump-sum items, payments shall be made to the Contractor in accordance with an accepted Progress Schedule of Values on the basis of actual work completed and accepted by the Owner at the final completion of the Project.

1.04 UNIT PRICE

A. For unit price items, payment shall be made based on the actual amount of work accepted by the Owner and for the actual amount of materials in place at the final completion of the Project, as confirmed by the final measurements.

B. After the work is completed and before final payment is made, the Engineer will make final measurements, with all required assistance from the Contractor, to determine the quantities of various items of work accepted as the basis for the final unit price payment.

1.05 PAYMENT FOR INCREASED OR DECREASED QUANTITIES

A. When alterations in the quantities of unit price work not requiring a Change Order(s), as herein provided for, are ordered and performed, the Contractor shall accept payment in full at the Contract unit price multiplied by the actual quantities of work constructed and accepted by the Owner at the completion of the project.

B. The actual percentage of each lump-sum bid item completed by the Contractor and accepted by the Owner at the final completion of the Project will be paid to the Contractor.

1.06 DELETED ITEMS

A. Should any items contained in the Bid Schedule(s) be found unnecessary for the proper completion of the work contracted, the Engineer may eliminate such items from the Contract. This action shall in no way invalidate the Contract and no financial allowance or compensating payment for anticipated profit, overhead, etc., will be made for items so eliminated in making final payment to the Contractor.

1.07 PARTIAL PAYMENTS

A. Partial payments will be made monthly as the work progresses. Partial payment will be made subject to the provisions of the General and Supplementary Conditions.

1.08 PAYMENT FOR STORED MATERIAL DELIVERED TO THE PROJECT

A. When requested by the Contractor and at the discretion of the Owner, payment may be made for all or part of the value of acceptable materials and equipment to be incorporated into bid items, which have not been used, and which have been delivered to the construction site or placed in storage places acceptable to the Owner. The Contractor shall provide receipts for all stored material items requested for reimbursement which clearly identify the stored material item, where it is to be constructed, the unit cost of the item, as well as the total cost of the delivered item(s), the quantity of the item, the brand name of the item, and the supplier. Note that there are additional documentation requirements and storage

requirements within the Contract Documents that must also be met before the Contractor can be reimbursed for these stored materials.

B. No payment shall be made for fuels, supplies, installation or connection hardware, lumber, false work, or other similar materials or on temporary structures or other work (items) of any kind which are not a permanent part of the Contract. Items having a value of less than $2,500 shall not be compensated for as a stored material item.

1.09 FINAL PAYMENT

A. If requested by the Engineer, the Contractor shall field verify all quantities in dispute by using visual observation, taped measurements, or other methods designated by the Engineer. The field verification shall be made in the presence of the Engineer and agreed to by both the Engineer and the Contractor. The Engineer will prepare a final adjusting Change Order that will adjust the final quantities of the project Bid Schedule to reflect the actual work accepted by the Owner and for which the Contractor will be compensated.

1.10 SCHEDULE OF VALUES

A. A schedule of values for the lump-sum bid items and some of the unit-price bid items as required by the Engineer shall be submitted and accepted before the first pay request is approved by the Engineer. The schedule of values shall be based on the prices bid in the Bid Schedule(s). Prices bid in the Bid Schedule(s) cannot be changed in the schedule of values; they can only be broken down into more detail so that the Engineer can more accurately review and approve the Contractor's pay application for the completed work.

1.11 MISCELLANEOUS CONSTRUCTION ITEMS

A. When pipe/service lines are constructed across a road, the road shall not be cut to perform this construction unless authorized in writing by the Engineer. Service lines are to be bored, jack and bored, or horizontally directionally drilled (HDD) under the road. Jetting of water lines or water service lines will not be allowed.

B. The Contractor shall take all precautions necessary to protect existing utilities, roads, and miscellaneous items from damage during construction.

C. The Contractor shall repair, relocate, or replace existing utilities, roadways, and miscellaneous items to pre-construction conditions.

D. All repairs, relocations, and replacements necessary are considered incidental to the work and will be at the Contractor's cost, with no cost to the Owner.

PART 2 PAY ITEM DESCRIPTIONS

2.01 BID

The descriptions provided in the following Paragraphs are to be used by the Bidder in preparing the Bid Schedule(s). They generally indicate how the major workscope items and their respective costs are to be separated into the line items listed in the Bid Schedule(s). These descriptions are not fully representative nor all-inclusive of the work required to complete the project in accordance with the Contract Documents. It is the Bidder's responsibility to include all required costs within the most appropriate line item(s).

2.02 BASE BID

Item 1. Mobilization/Demobilization and General Conditions (not to exceed 8% of the Base Bid)—This lump-sum item shall include and cover the costs for performing construction, preparatory, and overhead operations, including but not limited to moving personnel and equipment to and from the site; providing sanitary facilities and temporary utilities; providing project administration and management, insurance, bonds, and Owner and Engineer indemnification; and all other similar activities and facilities necessary for executing this project. This item shall not exceed 8% of the Base Bid amount. The Contractor will be paid 20% of this item upon completion of mobilization and 10% upon demobilization; the remainder will be prorated equally over the construction period.

Item 2. Screw Lift Station Upgrades—The Contractor shall furnish all labor, materials, equipment, and services for the improvements to the screw lift station at the East Water Reclamation Facility in accordance with the Contract Documents including but not limited to:

- Unload, move, and adjust the screw pumps.
- Install all coffer dams, pump-down equipment, piping, and valves.
- Remove three existing screw pumps and all associated supports, lubrication systems, and appurtenances.
- Demolish existing grease pumps and local safety switches for the three screw pumps.
- Load, transport, and dispose of demolished materials in an approved disposal facility in accordance with applicable federal, state, and local regulations and in accordance with the Contract Documents.
- Provide interior coating system, expansion joint, and crack injection repairs to the concrete structure for the screw pumps.
- Furnish and install three screw pumps, all associated supports, lubrication systems, and appurtenances. The Bid item is to include any anchor bolts, equipment, components, etc., that are not specifically included but are necessary to place the replacement screw pump into service.

- Install new electrical conduit, wire, starter panels, and related components and modify the existing motor control center associated with the three new screw pumps.
- Reconnect the proposed signal wiring to the existing control panel and supervisory control and data acquisition (SCADA) system to match existing.
- Include the costs for all other work, material, equipment, and items not included in other Bid items.
- Perform testing and startup.

All work shall be performed in accordance with the Contract Documents. Payment for this item will be on a lump-sum basis in accordance with a percentage of completion, in accordance with the Contractor's approved schedule of bid-item breakdown and upon Engineer verification.

Item 3. Refurbishment of Slide Gates—This item includes refurbishing the existing three slide gates. The Contractor shall be responsible for coordinating the refurbishment requirements with the slide gate manufacturer including but not limited to removing, shipping, repairing, and replacing. Payment for this item will be on a lump-sum basis in accordance with a percentage of completion, in accordance with the Contractor's approved schedule of bid-item breakdown and upon Engineer verification.

Item 4. Owner's Contingency—The Contractor shall furnish all labor, materials, equipment, and services to perform unforeseen work not included in the other Bid items that may be requested and approved by the Engineer and Owner. The scope of work and cost of this additional work shall be agreed on in writing and approved by the Engineer and Owner before the work begins. The Contractor will be paid based on the agreed-on schedule of values for the approved work.

2.03 DEDUCTIVE BID ALTERNATE

The Bidder shall submit its Bid on the basis of the Base Bid and shall provide separate negative Bid prices for the relative cost reduction for each deductive alternate, if any, described in the Bid Documents and as provided for on the Bid Form.

For determining the apparent low Bidder, Bids will be compared on the basis of the aggregate amount of the Base Bid, plus any combination of the deductive alternates as determined by the Owner.

Item A. Slide Gate Replacement—The cost for the lump-sum deductive bid alternate item in the Bid Form shall include full compensation for furnishing all labor, materials, equipment, and services related to replacing the three slide gates in kind with new slide gates in lieu of refurbishing the three gates as required in the Base Bid. This work shall include but not be limited to the gates, appurtenances, and structural modifications required to replace and secure the gates, warranties, testing, etc. If the Owner elects to include this optional deductive bid alternate, the relative cost reduction shall be applied to Bid Item 3, and payment for this item will

be on a lump-sum basis in accordance with a percentage of completion, in accordance with the Contractor's approved schedule of bid-item breakdown and upon the Engineer's verification.

Item B. Individual Bypass—The cost for the lump-sum deductive bid alternate item in the Bid Form shall include full compensation for furnishing all equipment and services related to an alternate bypass plan used to bypass and/or isolate individual screw pumps for replacement in lieu of the bypassing the entire screw pump station as required in the Base Bid. This work shall include but not be limited to any isolation materials (coffer dam, inflatable devices, etc.), bypass pumps (if required), accessories, etc. The approval of this deductive bid alternate shall depend on Owner and Engineer approval of a formally submitted alternate bypass plan that shall be required to be submitted alongside the Bid. If the Owner elects to include this optional deductive bid alternate, the relative cost reduction shall be applied to Bid Item 2, and payment for this item will be on a lump-sum basis in accordance with a percentage of completion, in accordance with the Contractor's approved schedule of bid-item breakdown and upon the Engineer's verification.

Item C. Omitting Concrete Repair of Effluent Channel—The cost for the lump-sum deductive bid alternate item in the Bid Form shall include full reduction of cost for furnishing all equipment and services related to the concrete repair of the effluent channel as indicated in the Contract Documents. This reduction of work shall include reduced bypass, coating, inspection, crack repair, and any other efforts as indicated in the Contract Documents to complete the repair of the effluent channel. If the Owner elects to include this optional deductive bid alternate, the relative cost reduction shall be applied to Bid Item 2, and payment for this item will be on a lump-sum basis in accordance with a percentage of completion, in accordance with the Contractor's approved schedule of bid-item breakdown and upon the Engineer's verification.

END OF SECTION

SECTION 01290
SCHEDULE OF VALUES

PART 1 GENERAL

1.01 SUBMITTALS

The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance:

A. To the Engineer, a proposed Schedule of Values allocated to the various portions of the Work, in accordance with Section 01000, Project Requirements, and Section 01200, Measurement and Payment.

B. Upon request of the Engineer, supporting data that will substantiate the values' correctness.

C. The accepted Schedule of Values shall be used as the basis for the Contractor's Applications for Payment.

D. An update and resubmittal of the Schedule of Values when Change Orders affect the listing or when the actual performance of the Work involves necessary changes of substance to values previously listed and approved.

E. Schedule of Values

1. Submit typed schedule on EJCDC 1910-8-E forms or another format as may be approved by the Engineer.
2. Submit Schedule of Values in PDF format via Owner-approved electronic transmittal method or on CD, or as duplicate hardcopies, within 10 days after the date of Owner-Contractor Agreement.
3. Format – Use the schedule of prices in the Bid Proposal. Show the cost breakdown for each lump-sum item. The lump-sum breakdown shall, at a minimum, use the Table of Contents of this manual outline. Identify each line item with the number and title of the major Specification Section. Identify site mobilization and demobilization, bonds and insurance, Record Drawings, photographs, and operations and maintenance manuals, etc.
4. For unit cost allowances, identify quantities taken from the Contract Documents multiplied by the unit cost to achieve the total for the item.

5. Include within each line item a direct proportional amount of the Contractor's overhead and profit.
6. Revise the schedule to list approved Change Orders with each Application for Payment.

1.02 CASH ALLOWANCES (IF USED)

A. Costs Included in Allowances—The cost of the product to the Contractor or subcontractor, less applicable trade discounts and applicable taxes.

B. Costs Not Included in the Allowance, But Included in the Contract Price—Product handling at the site, including unloading, uncrating, and storage; protection of products from elements and from damage; and labor for installation and finishing.

C. Contractor Responsibilities

1. Execute purchase agreement with designated supplier.
2. Arrange for and process shop drawings, product data, and samples. Arrange for delivery.
3. Promptly inspect products upon delivery for completeness, damage, and defects. Submit claims for transportation damage.

D. Differences between allowance amounts and actual costs will be adjusted by Change Order before final payment.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01310
CONSTRUCTION COORDINATION

PART 1 GENERAL

1.01 SCOPE OF WORK

A. The Contractor shall coordinate Work with that of other construction projects as needed.

B. Before starting Work and from time to time as the Work progresses, the Contractor and each subcontractor shall examine the work and materials installed by others as it applies to its own work and shall notify the Engineer immediately in writing if any conditions exist which will prevent satisfactory results in the installation of the system. Should the Contractor or subcontractor start work without such notification, it shall be construed as an acceptance of all claims or questions as to the suitability of the work of others to receive its Work. The Contractor shall remove and/or replace, at its own expense, all work under this Contract that may have to be removed on account of such defects or omissions.

1.02 SUBMITTALS

The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance:

A. The Contractor shall ensure that all drawing, product data, and samples comply with Contract Documents and field dimensions and clearances.

B. The Contractor shall submit requests for interpretation of Contract Documents in a timely fashion to ensure there are no disruptions with the Work as scheduled. Obtain instructions through the Engineer to resolve all queries.

C. Process requests for substitutions and Change Orders through the Engineer.

D. Deliver close-out submittals to the Engineer.

1.03 WORK SEQUENCE

A. The Contractor shall submit a preliminary Progress Schedule, in accordance with Section 01320, Progress Schedule, to the Engineer. After review, the Contractor shall revise and resubmit the Progress Schedule to comply with requested revisions.

1.04 CONSTRUCTION MOBILIZATION

The Contractor shall do the following:

A. Cooperate with the Owner in allocating mobilization areas on site for field offices and sheds, access, traffic, and parking facilities. During construction, the Contractor shall coordinate the use of the site and facilities through the Engineer.

B. Comply with the Engineer's procedures for intra-project communications: submittals, reports and records, schedules, coordination drawings, recommendations, and resolution of ambiguities/conflicts.

C. Comply with the Engineer’s instructions for use of temporary utilities and construction facilities.

D. Coordinate field engineering and layout work under instructions of the Engineer.

E. Coordinate scheduling, submittals, and work of the various sections of Contract Documents to ensure the efficient and orderly sequence of installation of construction elements, with provisions for accommodating items to be installed later.

F. Coordinate the sequence of Work to accommodate the Owner occupancy as specified in the Contract Documents.

G. In addition to Progress Meetings specified in Section 01320, Progress Schedule, hold pre-construction conferences with personnel and Subcontractors to ensure coordination of Work. The Engineer shall be informed of such meetings and shall be allowed to attend.

H. Coordinate the Work of various sections having interdependent responsibilities for installing equipment, connecting equipment, and placing such equipment in service.

I. Coordinate the use of project space and the sequence of installing civil, architectural, mechanical, structural, instrumentation, systems, and electrical work. Follow practicable routings for pipes, ducts, and conduits, with due allowance for available physical space; make runs parallel with lines of building. Use space efficiently to maximize accessibility for other installations, maintenance, and repairs.

J. Coordinate Work at existing facilities to minimize disruption of the Owner’s operations.

K. Assemble and coordinate close-out submittals specified in Section 01770, Project Closeout.

1.05 COORDINATION DRAWINGS

A. The Contractor shall provide information required by the Engineer for preparing coordination drawings.

B. The Contractor shall review drawings before submitting them to the Engineer.

1.06 CLOSE-OUT PROCEDURES

The Contractor shall do the following:

A. Notify the Owner when Work is considered ready for Substantial Completion.

B. Comply with the Owner's instructions to correct items of Work listed in executed Certificates of Substantial Completion.

C. Notify the Owner when Work has reached Final Completion.

D. Comply with the Owner's instructions for completing items of Work found incomplete in the Engineer's final inspection.

E. Comply with Section 01770, Project Closeout.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 GENERAL

A. All vehicles on the property or easement must be operational.

3.02 UTILITIES

A. The Contractor shall coordinate the activities of all utility companies with equipment in the construction area with the Contractor’s and Subcontractor’s Work.

3.03 CUTTING AND PATCHING

A. No cutting and patching of new Work will be accepted. All Work must be new and continuous in its final form.

END OF SECTION

SECTION 01320
PROGRESS SCHEDULE

PART 1 GENERAL

1.01 SCOPE OF WORK

A. All work of this Contract shall be scheduled and monitored by the Contractor using the Critical Path Method (CPM) and shall use the Precedence Diagram Method (PDM) of scheduling. The Contractor shall prepare all schedules and all monthly updates described in this Section. The Contractor will prepare revisions of the schedule to reflect changes in the Contractor's plan of performance or changes in the Work and submit these revisions to the Engineer for acceptance. The Engineer's acceptance of the scheduling documents is to ensure that all CPM Scheduling documents prepared by the Contractor are in conformance with the Contract Documents and Specifications described herein. This acceptance will not impose on the Engineer or Owner the responsibility for the schedule or for the sequencing, scheduling, or progress of the Work, nor will the acceptance interfere with or relieve the Contractor of full responsibility for the schedule and the means, methods, procedures, and sequence of construction.

B. The Contractor shall use the latest version of Primavera Scheduling software, or an approved equal, for all CPM Scheduling applications.

C. The Engineer or Owner may retain the professional services of a CPM Scheduling Consultant to assist in the review and acceptance of the CPM Scheduling documents prepared by the Contractor. Therefore, any reference to the Engineer or Owner within this Section may also indicate the involvement of the Engineer's or Owner's CPM Scheduling Consultant.

D. The Contractor shall prepare and maintain a detailed progress schedule throughout the construction of the Project. The schedule shall be the Contractor's working schedule and be used to plan, organize, and execute the Work, record and report actual performance and progress, and show how the Contractor plans to complete the Work. The schedule will be in the form of an activity-oriented network diagram (CPM).

E. When the Contractor prepares the CPM Schedule and the schedule is accepted by the Engineer, it shall become part of the Contract Documents and will be used by Contractor and Engineer to monitor the progress of the Project. The CPM Schedule may be revised to show changes in the Contractor's method or manner of performance or delays or authorized changes in the Work. All changes to the schedule will be made in accordance with Article 1.08 of this Section.

F. The Contractor acknowledges that free float belongs to the Owner.

1.02 PRELIMINARY 90-DAY CPM SCHEDULE

A. The Contractor shall develop and submit a 90-Day CPM Schedule at the pre-construction meeting as specified in Section IV, Article 209, of the City's Technical Specifications . This schedule shall be a computerized CPM Schedule showing only the early start, early finish of each work activity. The 90-Day Schedule shall contain work activities over the first 90 days, and the estimated durations for each work activity shall be 15 workdays or less. The balance of the job shall be shown in summary log. The 90-Day Schedule shall include but not be limited to site work, hazardous material removal, demolition, key procurement activities (i.e., submissions, approvals, fabrication, and delivery), equipment, mechanical, electrical, and plumbing coordination and any other work that will occur during the first 90 days. This 90-Day Schedule shall become part of the Detailed CPM Schedule.

1.03 DEFINITIONS

The following terms used in this Section shall have the following meanings:

A. *Activity.* A fundamental unit of work in a CPM Schedule establishing the time and resources required for performing or furnishing a part of the Work or a requisite step. Each Activity has defined geographical boundaries, time duration in days, and a detailed estimate of resources required to construct the task. Each activity is assigned a unique description, activity number, activity code, and a dollar value.

B. *Record Schedule.* The Record Schedule will have actual start dates and actual finish dates for all work Activities and Milestones necessary to complete the Work.

C. *Baseline Schedule.* The Engineer-accepted Proposed Baseline Schedule. The Baseline Schedule is the Contractor's plan which has been approved by the Engineer for completion of the Work in compliance with the Milestones listed in the Contract Documents and within the Contract Time. The Baseline Schedule may be revised only by the Engineer's approval of a Contractor-produced adjusted Baseline Schedule. The Baseline Schedule for the Work is the sole basis for (a) the monitoring of the Contractor's progress against Milestones and the Contract Time; (b) calculating Total Float or Contract Float; and (c) the evaluation and reconciliation of extensions in Contract Time, if any. The first Baseline Schedule shall be designated by all parties as the Baseline Schedule, Rev. 0. When Baseline Schedules are adjusted by the Contractor and approved by

the Engineer, they shall be designated as Baseline Schedule, Rev. 1, 2, 3, etc. (as appropriate) and shall replace the previously approved Baseline Schedule.

D. *Contract Float.* Workdays between the Contractor's expected date for early completion of the Work, or specified part, and the corresponding Contract Time.

E. *CPM Network.* The structure of the computerized schedule. The CPM Network accounts for the entire Work and defines the construction logic in terms of all of the Activities with their logical dependencies.

F. *Critical Path.* A series of Activities linked by dependencies that determine the shortest possible time to complete the Work.

G. *Early Dates.* The early start dates and early finish dates, i.e., the dates each Activity will start and finish if each is started at the earliest end of the range of dates that the CPM indicates the Activities can be performed.

H. *Excusable Delay.* An unforeseeable delay, beyond the control of the Contractor, experienced due to no fault or negligence by the Contractor, its subcontractors, or suppliers.

I. *Free Float.* The amount of time that any activity can be delayed without adversely affecting the early start of the following activity.

J. *Fragnet.* A predefined or individual segment of a network which represents a specified sequence of the Work. Fragnets shall be submitted which include all Activities, required resources, and costs and shall be submitted to the Engineer for approval of all Change Orders before their incorporation into the Baseline Schedule by the Contractor. A Fragnet shall be submitted before approval of any proposed logic changes. Fragnets are banded Activities representing a revised portion of the Baseline Schedule and shall be logically connected and constrained by previously existing predecessor and successor Activities, as applicable.

K. *Late Dates.* The late start dates and the late finish dates, i.e., the dates each Activity will start and finish if each is started at the latest end of the range of dates that the CPM Network indicates the Activities can be performed and still achieve the Milestones and Contract Time.

L. *Milestone.* A point of progress designated for the purpose of establishing start or finish times for a key aspect of the Work.

M. *Predecessor Activity.* An Activity which precedes another Activity (to which it is logically tied) in the CPM Network.

N. *Preliminary Schedule*. The Contractor's Baseline Schedule for the first 180 days of the Contract.

O. *Proposed Baseline Schedule.* The Proposed Baseline Schedule shall represent the Contractor's plan for completion of the Work in compliance with Milestones listed in the Contract Documents and within the Contract Time. It represents the Contractor's first complete planned schedule submitted for review and approval by the Engineer. The Proposed Baseline Schedule shall take into account all foreseeable activities to be accomplished by any separate contractors, utility owners, or the Owner's operations. The Proposed Baseline Schedule shall anticipate all necessary manpower and resources to accomplish activities within the durations set forth in the Proposed Baseline Schedule. The Proposed Baseline Schedule shall address and indicate all submittals required by the Contract and indicate the times allowed for review, resubmittal, and approval of submittals. Upon approval by the Engineer, the first Proposed Baseline Schedule shall become the Baseline Schedule, Rev. 0.

P. *Resource Loading.* The allocation of work force and equipment necessary for the completion of an Activity as scheduled.

Q. *Six-Week Schedule.* A detailed progress schedule taken from the Working Schedule, which discloses the plan for the next 6 weeks' Work and the actual schedule for the previous 6 weeks' Work.

R. *Successor Activity.* An Activity which follows another Activity (to which it is logically tied) in the CPM Network.

S. *Total Float.* The number of workdays by which a part of the Work in the Baseline Schedule or Revised Baseline Schedule may be delayed from its Early Dates without necessarily extending the Contract Time.

T. *Working Schedule.* When the Proposed Baseline Schedule (or a subsequent adjustment is made by the Contractor to the Baseline Schedule) is accepted by the Engineer and becomes the Baseline Schedule, Rev. 0, 1, 2, 3, etc., it shall be duplicated and become the Working Schedule. The Contractor shall update the Working Schedule monthly with a Data Date designated by the Engineer. The Working Schedule shall be updated monthly to reflect actual progress only and shall be the basis for determining monthly progress payments and the Contractor's performance in relation to the most recently approved Baseline Schedule. The Final Working Schedule shall be the Record Schedule.

1.04 DETAILED CPM SCHEDULE

A. The Detailed Network Diagram shall provide sufficient detail and clarity of form and technique so that the Contractor can plan, schedule, and control his work properly and the Engineer can readily monitor and follow the progress for all portions of the Work. The Detailed Network Diagram shall comply with the Contract Times of the Agreement and various limits imposed by the Contract Documents, including required sequencing of portions of the Work described in Section 01100, Summary of Work. The degree of detail shall be to the satisfaction of the Engineer, but the following factors shall have a bearing on the required depth of activity detail:

1. The structural breakdown of the Project.
2. Project phasing and/or milestones.
3. The type of work to be performed and the labor trades involved.
4. All purchase, manufacture, and delivery activities for all major materials and equipment.
5. Maintenance of facilities in operation.
6. Submittal and approval of shop drawings and material samples.
7. Plans for all subcontract work.
8. Crew flows and sizes.
9. Assignment of responsibility for performing all activities.
10. Access and availability to work areas.
11. Identification of interfaces and dependencies with preceding, concurrent, and follow-on subcontractors and contractors.
12. Testing and start-up of systems.
13. Planning for phased takeover by the Owner.

B. Activities shown shall be in workdays and shall have a maximum duration of 5 days, except in the case of non-construction activities such as procurement of materials and delivery of equipment. All durations shall be the result of definitive manpower and resource planning by the Contractor.

C. The Detailed Network Diagram shall be prepared using a computer plotter.

1.05 COMPUTERIZATION OF THE DETAILED CPM SCHEDULE

A. The mathematical analysis of the Detailed Network Diagram shall be made by computer, and a tabulation for each activity shall include the following:

1. Unique event numbers.
2. Activity descriptions.
3. Durations in workdays for each activity.
4. Earliest start date (by calendar date).

5. Earliest finish date (by calendar date).
6. Latest start day (by calendar date).
7. Latest finish day (by calendar date).
8. Slack or total float in workdays.
9. Percentage of activity completed.

B. The following computer outputs shall be prepared as part of the initial schedule submission and each update thereafter:

1. Activity file sort.
2. Eight-week "Look Ahead" detailed bar chart.
3. Summary bar chart.
4. Additional computer sorts to the schedule as required by the Owner.

1.06 COMPLETION REQUIREMENT

A. The 90-Day Schedule shall be completed and submitted at the pre-construction meeting as specified in Section IV, Article 209, of the City's Technical Specifications.

B. The Detailed CPM Schedule shall be prepared within 30 calendar days after the date indicated in the Notice to Proceed.

C. If the Contractor fails to provide the required CPM scheduling documents to the Engineer within the time prescribed and/or revisions of the scheduling documents within the required time, the Contractor shall be in default of the Contract requirements and the Engineer may withhold approval of progress payments until such time as the Contractor submits the required information.

D. Notwithstanding the implementation of the Progress Schedule, it shall be the sole responsibility of the Contractor to complete the Work within the time of completion required by the Contract.

1.07 UPDATINGS

A. The 90-Day CPM Schedule shall be updated monthly until the Engineer accepts the Detailed CPM Schedule.

B. The first update of the Detailed CPM Schedule shall take place 60 calendar days after the Notice to Proceed with subsequent updates performed monthly at the jobsite for the duration of the contract.

C. The Contractor shall update the Detailed CPM Schedule monthly, using a cutoff/data date agreeable to the Contractor and the Engineer. This cutoff/data

date shall be consistent from month to month. The update information shall include but not be limited to the following:

1. Actual start dates.
2. Actual completion dates.
3. Activity percent completion.
4. Remaining duration of activities in progress.

D. The Contractor shall update all the scheduling documents and submit these documents to the Engineer within 5 workdays of the cutoff/data date.

E. The Contractor shall submit seven copies of the CPM schedule and one electronic copy of the CPM schedule on a CD.

F. As part of the normal CPM update, the Contractor shall prepare a written narrative report highlighting the progress during the past update period. The written narrative report shall include but not be limited to the following information:

1. Summary of work accomplished during the past update period.
2. Milestone Comparison Chart.
3. Analysis of Critical Path(s).
4. Analysis of Secondary Critical Path(s). Secondary Critical Path is defined as float within 10 workdays of Critical Path.
5. Analysis of time lost/gained during the update period.
6. Identification of problem areas.
7. Identification of change orders and/or any delay that is impacting/delaying the project schedule.
8. Solutions to current problems.

G. The Contractor is required to attend and participate in a CPM update review meeting with the Engineer. Attendance is mandatory. This meeting will take place 7 workdays after the cutoff/data date, or during progress meetings as decided by the Owner and the Engineer. The purpose of this meeting is to review past progress, current status, problem areas, and future progress. The Contractor's narrative report will be reviewed at this meeting.

H. All schedule update information outlined above will be reviewed and accepted by the Engineer.

1.08 RECOVERY SCHEDULE

A. If the Contractor fails to achieve the planned progress, as indicated in the approved/updated detailed CPM Schedule, and the Contractor's lack of progress

delays the Critical path and/or an intermediate milestone by more than 10 workdays (monthly or cumulatively), the Contractor shall submit to the Engineer for review and acceptance a proposed Recovery Schedule indicating how the Contractor will recover the time lost.

B. If the Contractor fails to submit a Recovery Schedule and/or fails to cooperate with the Engineer in the Recovery Schedule process, the Owner can immediately order the Contractor to accelerate completion of the late activities which have been delayed by whatever means necessary without any additional costs to the Owner. The Owner can withhold future progress payments until the Contractor's progress is in compliance with the Contract Schedule or until the Owner has approved by Change Order proposed adjustments to the contract milestones, extension of contract time, or modification of the Contract Schedule.

1.09 CHANGE ORDERS, DELAYS, AND EXTENSIONS OF TIME

A. When proposed Change Orders, approved Change Orders, or any delays are experienced and the Contractor believes the Change Order/Delay is causing delay to an intermediate contract milestone or to the project completion, the Contractor shall submit to the Engineer a Time Impact Analysis, explaining the influence of each Change Order/Delay on the current updated Contract CPM Schedule. The Contractor shall prepare a "Fragnet" (network analysis) of each Change Order/Delay on the current updated Contract CPM Schedule. The analysis will demonstrate the time impact based on the date the change is given to the Contractor, the status of construction at that point in time, and the event time computation of all affected activities. The event times used in the analysis shall be those included in the latest updated copy of the detailed CPM Schedule closest to the time of delay or as accepted by the Engineer.

B. For the Contractor to be entitled to an extension of Contract time to an intermediate contract milestone and/or to the project completion, the Time Impact Analysis must show that the Change Order/Delay impacts the intermediate contractual milestone date and/or the updated CPM Schedule's Critical Path, thereby directly impacting the project completion date. Change Orders/Delays that do not impact intermediate contractual milestones and/or the critical path and impact activities with float will not be considered as a delay to the project and no extension of time will be granted.

C. The Contractor must submit a written analysis within 7 calendar days after a delay occurs or authorized change in work is given to the Contractor. If the Contractor does not submit a written analysis for specific Change Order(s) or Delay(s) within the specified period of time, then it is mutually agreed that the particular Change Order of Delay has no time impact on the Project CPM Schedule and no time extension is required.

D. The Engineer will accept or reject each Time Impact Analysis within 14 calendar days after submittal unless subsequent meetings and negotiations are necessary. Upon the Engineer's acceptance, the Contractor will incorporate fragnets illustrating the influence of the Change Orders and Delays into the Detailed CPM Schedule during the first update after agreement is reached.

1.10 PROGRESS MEETINGS

A. The Owner will conduct progress meetings at least once per month to discuss the progress of the Work. The Contractor and any subcontractors the Contractor deems necessary shall attend these meetings. At the Owner's discretion, the frequency of the meetings may be increased if the progress of the Work is not satisfactory or if coordination problems should arise.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01325
CONSTRUCTION PHOTOGRAPHS

PART 1 GENERAL

1.01 SCOPE OF WORK

A. The Contractor shall have digital photos and videos made of the Work from views and at such times as directed by the Owner. These photos and videos shall represent a visual history of the Project, from Contract Award through Contract Completion.

B. The requirements of this Section constitute a minimum requirement, but the Owner may request additional photos or videos at their discretion for complete documentation of the work performed.

C. The Contractor shall also use additional digital photography as necessary to record and facilitate resolution of on-site issues through the transmission of photos by e-mail or other electronic submittal forum from the site to the Owner's offices.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 DIGITAL PHOTO REQUIREMENTS

A. Digital photos shall be in color. Provide one copy of each digital photo via electronic submittal to the Owner.

B. Provide photos taken of each of the major items during construction.

C. View and Quantities Required: A minimum of 30 photos per month clearly showing project status and key elements of construction.

D. Deliver digital photos to the Owner on a monthly basis.

E. Photographs shall be from locations to illustrate the condition of construction and the state of progress adequately.

F. The Contractor shall provide before and after photos of each portion of the site. The below-ground facilities shall include before, during, and after photos of all equipment, walls, floor, piping, utility crossings, and supports. At major locations,

photos shall include before, during, and after prints and all prints all submitted electronically in ascending date order to show the Work as it progresses.

3.02 DIGITAL VIDEO RECORDING REQUIREMENTS

A. The Contractor shall provide to the Owner color digital video of each major facility and structures and facilities adjacent to the construction before construction starts, during construction, and when construction has been completed. Videos shall include the entire site and areas of adjacent properties within 100 feet of the limit of the Work. Special effort shall be made to show the existing improvements and features affected by the work.

B. Approximately every 2 weeks, 5 minutes of digital video shall be submitted to the Owner showing Work completed, Work in progress, Work started, and problems that occurred since the last digital video was made.

C. The Contractor shall maintain the master video of each portion of the facility on the Work site. The master video shall be a running chronicle of construction progress. The Contractor shall combine the bi-weekly video onto the master video.

D. The bi-weekly video shall be submitted to the Owner within 10 working days after recording and the bi-weekly videos may include multiple locations.

E. All videos shall be recorded with character generator operating with date, time, and location on screen. During video recording, the Contractor shall narrate the video, explaining what is being shown, problems that have occurred, and what is being done.

3.03 AERIAL PHOTOS AND VIDEOS

A. The Contractor shall obtain digital, true-color, aerial photos and aerial videos using aerial drones or other approved means of the entire project site before construction begins**,** during construction at a point directed by the Owner, and at final completion showing the entire completed construction project.

B. The Contractor is required to secure all permits and approvals from authorities having jurisdiction before any aerial or drone flights and shall have licensed pilots/drone pilots performing the flights in accordance with applicable regulations.

C. Provide a minimum of 10 aerial digital photos from each flight.

D. Aerial videos shall be a minimum of 5 minutes in length or as needed to show the projects from all sides with slow panning, tilting, and/or translating views of the work sites.

E. Provide a digitally collected orthophoto mosaic supplied in Geotiff format via digital submittal of both pre-construction and post-construction conditions. The final color-balanced, true-color orthophoto mosaic will be projected in North American Datum of 1927 (NAD 27), state plane west, and all vertical reference shall be North American Vertical Datum of 1988 (NAVD 88), US feet, and shall meet a final accuracy of plus or minus 5 feet.

F. The Contractor shall submit an aerial photo and video plan to the Owner for approval before conducting the work. The plan shall include a description of the proposed views, lengths of each scene, equipment to be used, schedule, and other relevant information to ensure the Owner's needs are met.

3.04 PHOTO AND VIDEO INFORMATION

A. Each digital photo and video file shall be digitally tagged with the following data or the file name shall be referenced from a log that contains the following information for each photo and video:

1. Digital photo or video digital file name/number.
2. Project name.
3. Contract number.
4. Name of Contractor.
5. Date photo or video was taken.
6. Photographer name.
7. Description of location, view, and construction items the photo displays.

B. All photos and videos shall be clear, unobstructed, sharply focused, and free of distortion.

END OF SECTION

SECTION 01330
SUBMITTALS AND ACCEPTANCE

PART 1 GENERAL

1.01 SCOPE OF WORK

A. The Contractor shall submit documentation that describes the Work to be performed under the Contract as required in this Section. This documentation will be for the Engineer and Owner's review and use. The documentation furnished by the Contractor must enable the Engineer and Owner to verify the Contractor's performance and compliance with Contract requirements. The documentation shall cover all services and deliverables required and secured by the Contract Documents.

1.02 SUBMITTALS

A. General—The Contractor shall submit the following:

1. Project documentation: For the Engineer and Owner's internal use and shall include all information that will be essential for the facility's operations, maintenance, training, and repair of equipment and facilities supplied by the Contractor. The Contractor shall submit all documentation necessary to ascertain compliance with technical/contractual provisions.
2. Shop drawings: Drawings, schedules, diagrams, warrant, and other data prepared specifically for this Contract by the Contractor or through the Contractor by way of subcontractor, manufacturer, supplier, distributor, or other lower-tier contractor to illustrate a portion of the Work.
3. Product data: Preprinted materials such as illustrations, standard schedules, performance charts, instructions, brochures, diagrams, manufacturer's descriptive literature, catalog data, and other data to illustrate a portion of the Work, but not prepared exclusively for this Contract.
4. Samples: Physical examples of products, materials, equipment, assemblies, or workmanship that are physically identical to portions of the Work, illustrating portions of work, or establishing standards for evaluating appearance of finished work or both.
5. Installation Lists: All manufacturers or equipment suppliers who propose to furnish equipment or products shall submit an installation list to the Owner with the required Shop Drawings. The installation list shall include all installations where identical equipment has been installed and has been operating for at least 1 year.

6. Administrative submittals: Data presented for reviews and acceptance to ensure that administrative requirements of the project are adequately met but not to ensure directly that work is in accordance with the design concept and in compliance with Contract Documents.

7. Mockups: Before installing work requiring mockups, the Contractor shall build mockups for each form of construction and finish required using materials indicated for the completed Work, as follows:

    a. Build mockups in the location and of the size directed by the Engineer.
    b. Notify the Engineer 7 days in advance of dates and times when mockups will be constructed.
    c. Demonstrate the proposed range of aesthetic effects and workmanship.
    d. Obtain the Engineer’s acceptance of mockups before starting work, fabrication, or construction.
    e. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
    f. Demolish and remove mockups when directed by the Engineer.

B. Coordination

1. Submittals and schedules shall be checked and coordinated with the Work of all trades involved before they are submitted and shall bear the Contractor's stamp of approval as evidence of such checking and coordination. Drawings or schedules submitted without this stamp of approval shall be returned to the Contractor for resubmission.

C. Start of Work

1. Within 30 calendar days after the Notice to Proceed for the project, the Contractor shall submit to the Engineer a Contract Data Requirements List that defines all data to be submitted under this Contract. Included in this list shall be the names of all proposed manufacturers furnishing specified items to the extent known. Review of this list by the Engineer shall in no way relieve the Contractor from providing materials, equipment, systems, and structures fully in accordance with the Specifications.

D. General Requirements

1. The Contractor shall prepare, assemble, and submit all documents as described herein. The Contractor shall submit certification that the documents prepared conform to the Contract requirements and will result in a complete and operable project. The Owner shall review the

Contractor’s documents for conformance to the Contract requirements and may comment on the documents.

2. The Contractor shall approve and certify all project documents. The Contractor’s failure to certify the documents or failure to provide documents that demonstrate conformance to the Contract requirements are grounds for rejection. The Contractor shall be responsible for and bear all costs for proceeding with any part of the Work that fails to meet the Contract requirements.
3. Submittal of documents for the Engineer’s review shall in no way relieve the Contractor of full responsibility for providing a complete, safe, reliable, operating, and coordinated Work (system/equipment/facilities) that comply with these Contract documents.

E. Requests for Substitution

1. All requests for substitution shall clearly and specifically indicate any and all differences or omissions between the products specified as basis of design and the product proposed for substitution. Data shall include but not be limited to differences as follows for both the specified and substituted products:

    a. Principle of operation.
    b. Materials of construction or finishes.
    c. Thickness or gauge of materials.
    d. Weight of item.
    e. Deleted features or items.
    f. Added features or items.
    g. Changes in other work caused by the substitution.
    h. If the substitution contains differences or omissions not specifically called to the attention of the Engineer, the Engineer reserves the right to require equal or similar features to be added to the substituted product at the Contractor's expense.

F. Submittal Requirements and Procedures

1. Drawing Formats and Requirements

    a. Drawings—All Drawings and Shop Drawings shall be prepared in 24-x-36-inch or larger format and shall have a blank area of 3 x 4 inches in the lower right hand corner above the title block. Each Drawing shall indicate the following information in the title block:

        (1) Title and Drawing Number.

(2) Date of Drawing or Revision.
(3) Name of Building or Facility.
(4) Name of Contractor or subcontractor.
(5) Drawing Contents and Locations.
(6) Specification Section and Subsection Numbers.

b. All drawings shall be submitted via electronic transmittal in PDF format or other formats as may be required by the Owner for review.

2. Product Data

a. Requirements—Product data shall include all catalog cuts, performance surveys, test reports, equipment lists, material lists, diagrams, pictures, and descriptive material. All product data shall be submitted in either 8.5-x-11-inch or 11-x-17-inch size formats. The submittal information shall show the standard and optional product features, as well as all performance data and specifications. The manufacturer's recommendation for special tools shall be supplied.
b. All product data shall be submitted via electronic transmittal in PDF format or other formats as may be required by the Owner for review.

3. Samples—The Contractor shall furnish samples required by the Contract Documents, for review by the Owner. Samples shall be delivered to the Engineer as specified or directed.

a. All samples shall be of sufficient size and quantity to clearly illustrate the functional characteristics of the product, with integrally related parts and attachment devices. The samples shall show the full range of color, texture, and pattern.
b. The Contractor shall submit a minimum of four samples of items submitted. All samples shall be marked with required submittal information, as specified above.

4. Color, Texture, and Pattern Charts

a. The Contractor shall submit color, texture, or pattern charts of all required finishes.
b. A minimum of four charts of each item shall be submitted.

5. Submittal Information Requirements

a. When used in the Contract Documents, the term "Submittal Information" shall be considered to mean the following information at a minimum:

(1) Contract Name.
(2) Contract Number.
(3) Location Within Facility.
(4) Date Submitted.

b. Drawings—The Contractor shall mark submittal information on all Drawings in the left half of the 3-x-4-inch block as described above.

c. Product Data and Manufacturer's Literature—The Contractor shall mark all product data and manufacturer's literature with submittal information and note which item is being furnished. The Contractor shall mark the option and supplies to be furnished with the item. Do not submit the manufacturer's general catalog: submit only items being installed or delivered. When manuals are being submitted, the Contractor shall mark submittal information on both the cover and title page. If manuals being submitted contain more than just one item, each item must be marked, and only Contract name and number is to be marked on the cover and title page.

6. Training, Operation and Maintenance Manuals

a. The Contractor shall submit to the Engineer for review and acceptance of manufacturer's installation, operations, lubrication, maintenance, and training manuals for all equipment installed or delivered under this Contract. All manuals shall have submittal information marked on the front cover, title page, and three places inside the manual. If the manual being submitted is for different components, mark the front cover and title page only. Each component section must be marked with the Specification Section and subsection numbers.

b. Operations and Maintenance Manual shall conform to requirements defined in Section 01830, Operations and Maintenance Manuals.

G. Required Submittals

1. Architectural and Structural Submittals

a. This Section specifies general procedural requirements for contractual submittals for the following structural schedules, product data, samples, and manufacturer's certificates.

(1) Product Data—The Contractor shall provide product data for all architectural and structural items, options, and other data and provide supplemental manufacturer's standard data for information unique to the Work and installation. The submittals shall reflect all items delivered or installed under this Contract.

(2) Samples—The Contractor shall provide all samples required under this Specification including color charts and product samples.

(3) Material, equipment, and installation and demolition Specifications.

2. Mechanical and Electrical System Submittals

a. This Section specifies general procedural requirements for mechanical schedules, performance data, control diagrams, and other submittal data.

b. The Contractor shall submit the following:

(1) Performance Data.

(2) Power and Riser Diagrams—Single line riser, power diagrams, and all conduit runs shall be provided for all equipment and facilities.

(3) Wiring Diagrams—Elementary controls diagrams and separate wiring diagrams for mechanical and electrical unit/subsystem. Drawing for starting and shutdown of equipment including controls shall be provided, including a comprehensive description of operation.

(4) Finished Data—Complete surface preparation and finished data for all mechanical and electrical unit/subsystems shall be provided, including a complete list of cleaning instructions.

(5) Factory Testing—Detailed description of factory testing procedures, reporting procedures and criteria for test passing or failing shall be provided for all mechanical and electrical units/subsystems. Testing shall comply with the General Requirements and Technical Requirements Sections.

(6) Site (Field) Testing and Acceptance—Detailed description of site testing and acceptance tests including descriptions of procedures, testing equipment, reporting procedures, and criteria for passing or failing tests shall be provided for all mechanical and electrical units/subsystems. Testing shall comply with General Requirements and Technical Requirements.

(7) Factory Test Report—After fabrication and testing, the Contractor shall submit the results of tests. No shipment of any mechanical and electrical unit/subsystem shall be allowed without the written certification from the Contractor that the equipment conforms to the Contract requirements.

(8) Site Test and Acceptance Report—Site test and acceptance reports shall be submitted to the Owner and Engineer.

(9) Operations and Maintenance Manuals—The Contractor shall furnish manuals for all mechanical and electrical equipment specified under this Contract. Each manual shall include the following at a minimum:

(a) Description of equipment.
(b) Record shop drawing.
(c) Operation and maintenance instructions.
(d) Part lists.
(e) Equipment ratings.
(f) Valve list.
(g) Lubrication instructions.

c. Compliance with this Section does not relieve the Contractor from compliance with the requirements of Section 01830, Operations and Maintenance Manuals.

H. Submittal Review

1. The Owner's review of the Contractor's documents shall not relieve the Contractor of the responsibility for meeting all of the requirements of the Contract nor of the responsibility for correcting the documents furnished. The Contractor shall have no claim for additional cost or extension in time because of delays due to revisions of the documents that may be necessary for ensuring compliance with the Contract.

2. The Engineer will review a submittal or re-submittal once, after which the cost of review shall be borne by the Contractor. The cost of Engineering shall be equal to the Engineer's full cost.

3. No partial submittals will be reviewed. A submittal or re-submittal not complete will be returned to the Contractor for completing and re-submittal.

4. Documents submitted by the Contractor for approval by the Engineer will be returned bearing a project-specific stamp bearing the dated signature of the reviewer and one of four boxes checked:

    a. NO EXCEPTIONS NOTED—This indicates that the submittal appears to comply with the requirements of the performance specifications and that the Work may proceed.
    b. MAKE CORRECTIONS NOTED—This indicates that the reviewer has added a minor correction to the submission and that the Work (modified in accordance with the correction comment) may proceed. The Contractor shall accept the responsibility of the modified document and resulting Work with no additional compensation.
    c. AMEND AND RESUBMIT—This indicates that the submittal will require Contractor modifications based on the reviewer's comments that accompanied the returned submittal. The Contractor will be cautioned that work may not proceed under this review status.
    d. REJECTED—This indicates that the submittal is not in conformance with the requirements of the performance Specifications and cannot be modified to gain compliance. A new submittal will be required in the instance of a "reject" status and the Contractor will be cautioned that work may not proceed under this condition.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 SUBMITTAL PROCEDURES

A. Before submitting documents for the Owner’s review, the Contractor shall review the documentation for conformance to the Contract requirements. Submittals shall be complete and comprise a logical division of the Contract Work.

B. All documentation submitted by the Contractor to the Engineer shall be accompanied by a letter of transmittal and shall be submitted in a sequence that allows the Engineer to have all of the information necessary for checking and accepting a particular document at the time of submittal.

C. Each document shall be identified by a document number, Contract number, Contract name, location, Specification Section, subsection numbers, and submittal date. Where a manual/drawing is revised to reflect a change in design or a change for any other reason, each such revision shall be shown by a revision number, date, and subject in a revision block. Indication of official approval by the Contractor's Project Manager shall also be included. To permit rapid location of the revision, additional notation shall be made in the manual opposite the line or area where the change was made and identified by the corresponding revision number.

3.02 DOCUMENTATION CONTROL AND SUBMITTAL SEQUENCING

A. The Contract Data Requirements List shall be updated and resubmitted to the Owner monthly, throughout the duration of the Contract. This list shall identify the Contractor’s submittal number, proposed and actual submittal date, Contract Specification Section Number, Paragraph, Item of the Work, and type of document.

B. The Contractor shall work with the Engineer to provide a regulated flow of submittals that allows the Engineer to review the submittals in the defined time frame without undue delays. Monthly the Contractor shall provide the Engineer a schedule of the approximate quantities and delivery dates for all submittals due for the next 120 days.

3.03 FINAL DRAWINGS

A. The Contractor shall submit the Final Drawing Package to the Engineer for review at Substantial Completion. The Contractor shall be provided with files of the Contract Drawings in AutoCAD or Autodesk DWG, as specified by the Owner. Final Drawings shall be prepared in AutoCAD or Autodesk DWG with the same version used for the Contract Drawings and shall be provided

electronically in AutoCAD or Autodesk DWG. The Contractor may request to use a different version, but it must be approved by the Engineer.

B. Final Drawings shall also be provided in hardcopy format, two copies, printed at the full size of the original Contract Drawings, 24 by 36 inches at a scale of 1 inch = 20 feet.

3.04 REQUIREMENTS FOR SUBMITTAL

A. Additional documents, drawings, interface data, and other pertinent project submittal data are listed in specific sections of this Contract.

3.05 RECORD PRINTS

A. The Contractor shall submit one set of all record prints before final completion. The record print or project records shall include submittals, catalog cuts, drawings, calculations, test reports, manufacturer's data, maintenance manuals, installation instructions, and operating manuals. All "record prints" shall be delivered to the Owner in three-ring binders with dividers and shall be placed in order by Specification Section.

END OF SECTION

SECTION 01350
ENVIRONMENTAL PROTECTION PROCEDURES

PART 1 GENERAL

1.01 SCOPE OF WORK

A. The Work covered by this Section consists of furnishing all labor, materials, and equipment and performing all work required for the prevention of environmental pollution in conformance with applicable laws and regulations during and as the result of construction operations under this Contract. In this Section *environmental pollution* is defined as the presence of chemical, physical, or biological elements or agents which adversely affect human health or welfare, unfavorably alter ecological balances of importance to human life, affect other species of importance to man, or degrade the utility of the environment for aesthetic and/or recreational purposes.

B. The control of environmental pollution requires considering air, water, and land and involves managing noise and solid waste as well as other pollutants.

C. The Contractor shall schedule and conduct all work in a manner that will minimize the erosion of soils in the area of the Work. The Contractor shall provide erosion-control measures such as diversion channels, sedimentation or filtration systems, berms, staked silt fence, seeding, mulching or other special surface treatments that are required to prevent silting and muddying of streams, rivers, impoundments, lakes, etc. All erosion-control measures shall be in place in an area before any construction activity in that area. Specific requirements for erosion and sedimentation controls are specified in Section 02370, Erosion and Sedimentation Control.

D. This Section is intended to ensure that construction is achieved with a minimum of disturbance to the existing ecological balance between a water resource and its surroundings. These are general guidelines. It is the Contractor's responsibility to determine the specific construction techniques to meet these guidelines.

E. All phases of sedimentation and erosion control shall comply with and be subject to the laws of the State of Florida and the Project Environmental Resource Permit.

1.02 WORK SEQUENCE

A. Before beginning the Work, the Contractor shall meet with the Engineer to establish agreed-upon compliance with these provisions and administration of the environmental pollution control program.

B. The Contractor shall remove temporary environmental control features when approved by the Engineer and incorporate permanent control features into the project at the earliest practicable time.

1.03 REFERENCE STANDARDS

A. Reference standards and recommended practices referred to in this Section shall be the latest revision of any such document in effect at the bid time. The following documents are a part of this Section. Where this Section differs from these documents, the requirements of this Section shall apply.

B. The Contractor shall comply with all applicable Federal, State, and local laws and regulations concerning environmental pollution control and abatement.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 EROSION CONTROL

A. The Contractor shall provide positive means of erosion control such as shallow ditches around construction to carry off surface water. Erosion-control measures, such as temporary vegetation, siltation basins, mulch check dams, mulching, jute netting, and other equivalent techniques shall be used as appropriate. Surface water shall be prevented from flowing into excavated areas. At the completion of the Work, erosion and sedimentation controls shall be removed and the ground surface restored to its original condition.

3.02 PROTECTION OF STREAMS AND SURFACE WATERS

A. Care shall be taken to prevent or reduce to a minimum any damage to any stream or surface water from pollution by debris, sediment, or other material or from the manipulation of equipment and/or materials in or near such streams. Water that has been used for washing or processing or that contains oils or sediments that will reduce the quality of the water in the stream shall not be directly returned to the stream. Such waters shall be diverted through a settling basin or filter before being directed into streams or surface waters.

B. The Contractor shall not discharge water from dewatering operations directly into any live or intermittent stream, channel, wetlands, surface water, or any storm sewer. Water from dewatering operations shall be treated by filtration, settling

basins, or other approved method to reduce the amount of sediment contained in the water to allowable levels.

C. All preventative measures shall be taken to avoid spillage of petroleum products and other pollutants. In the event of any spillage, prompt remedial action shall be taken in accordance with a contingency action plan approved by the FDEP. The Contractor shall submit two copies of approved contingency plans to the Engineer.

D. Water being flushed from structures or pipelines after disinfection with chlorine shall be treated with a dechlorination solution approved by the Engineer before discharge.

3.03 PROTECTION OF LAND RESOURCES

A. After completion of construction, the Contractor shall restore land resources within the project boundaries and outside the limits of permanent work to a condition that will appear to be natural and not detract from the appearance of the project. All construction activities shall be confined to areas shown on the Drawings.

B. Outside of areas requiring earthwork for the construction of the new facilities, the Contractor shall not deface, injure, or destroy trees or shrubs nor remove or cut them without prior approval. No ropes, cables, or guys shall be fastened to or attached to any existing nearby trees for anchorage unless specifically authorized by the Engineer. Where such special emergency use is permitted, the Contractor shall first wrap the trunk with a sufficient thickness of burlap or rags over which softwood cleats shall be tied before any rope, cable, or wire is placed. The Contractor shall in any event be responsible for any damage resulting from such use.

C. The Contractor shall protect trees that may possibly be defaced, bruised, injured, or otherwise damaged by the construction equipment, dumping, or other operations by placing boards, planks, or poles around them. Monuments and markers shall be protected similarly.

D. Any trees or other landscape features scarred or damaged by the Contractor's equipment or operations shall be restored as nearly as possible to their original condition. The Owner will decide the method of restoration to be used and whether damaged trees shall be treated and healed or removed and disposed of.

1. All scars made on trees by equipment, construction operations, or by the removal of limbs larger than 1 inch in diameter shall be coated as soon as possible with an approved tree wound dressing. All trimming or pruning

shall be performed in an approved manner by experienced workmen with saws or pruning shears. Tree trimming with axes will not be permitted.

2. Climbing ropes shall be used where necessary for safety. Trees that are to remain, either within or outside established clearing limits, that are subsequently damaged by the Contractor and, in the opinion of the Owner, are beyond saving shall be immediately removed and replaced.

E. The Contractor's storage and other construction buildings required temporarily in the performance of the work shall be located in cleared portions of the job site or areas to be cleared as shown on the Drawings and approved by the Engineer and shall not be within wetlands or floodplains. Preserving the landscape shall be required in the selection of all sites and in the construction of buildings. Drawings showing storage facilities shall be submitted for the Engineer's approval.

F. If the Contractor proposes to construct temporary roads or embankments and excavations for plant and/or work areas, the Contractor shall submit the following for approval at least 10 days before the scheduled start of such temporary work:

1. A layout of all temporary roads, excavations, embankments, and drainage to be constructed within the work area.
2. Details of temporary road construction.
3. Drawings and cross sections of proposed embankments and their foundations, including a description of proposed materials.
4. Landscaping drawings showing the proposed restoration of the area. The proposed removal of any trees and shrubs outside the limits of the existing clearing area must be indicated. Locations of guard posts or barriers required to control vehicular traffic and protect trees and shrubs to be maintained undamaged must also be indicated. The drawings shall provide for the obliteration of construction scars as such and shall provide for a natural appearing final condition of the area. Modification of the Contractor's approved drawings shall be made only with the written approval of the Engineer. No unauthorized road construction, excavation, or embankment construction including disposal areas will be permitted.

G. The Contractor shall remove all signs of temporary construction facilities such as haul roads, work areas, structures, foundations of temporary structures, stockpiles of excess waste materials, or any other vestiges of construction as directed by the Engineer. Excavating, filling, and plowing of roadways are expected to be required to restore the area to near natural conditions which will permit the growth of vegetation the roadway areas. The disturbed areas shall be prepared and seeded as approved by the Engineer or Owner.

H. All debris and excess material will be disposed of outside wetland or floodplain areas in an environmentally sound manner.

3.04 PROTECTION OF AIR QUALITY

A. Burning—Burning will not be permitted at the project site for the disposal of refuse and debris.

B. Dust Control—The Contractor shall maintain all excavations, embankment, stockpiles, access roads, waste areas, borrow areas, and all other work areas within or outside the project boundaries free from dust which could cause the standards for air pollution to be exceeded and which would cause a hazard or nuisance to others.

C. An approved method of stabilization consisting of sprinkling or other similar methods will be permitted to control dust. The use of petroleum products is prohibited. The use of chlorides is prohibited.

D. To be approved, sprinkling must be repeated at such intervals as to keep all parts of the disturbed area at least damp at all times, and the Contractor shall have sufficient competent equipment on the job to accomplish this. Dust control shall be performed as the Work proceeds and whenever a dust nuisance or hazard occurs, as determined by the Owner.

3.05 NOISE CONTROL

A. The Contractor shall make every effort to minimize noises caused by the construction operations. Equipment shall be equipped with silencers or mufflers designed to operate with the least possible noise in compliance with Federal and State regulations.

3.06 MAINTENANCE OF POLLUTION-CONTROL FACILITIES DURING CONSTRUCTION

A. During the life of this Contract, the Contractor shall maintain all facilities constructed for pollution control as long as the operations creating the particular pollutant are being carried out or until the material concerned has become stabilized to the extent that pollution is no longer being created.

3.07 PERMIT COMPLIANCE REQUIREMENTS

A. The Contractor shall comply with all conditions of permits and crossing agreements obtained by the Owner or required to be obtained by the Contractor, including but not limited to:

1. City of Clearwater.
2. Pinellas County.

END OF SECTION

SECTION 01355
SPECIAL PROVISIONS

PART 1 GENERAL

1.01 SUBMITTALS

A. The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance.

1.02 REFERENCE STANDARDS

Reference standards and recommended practices referred to in this Section shall be the latest revision of any such document in effect at the bid time. The following documents are a part of this Section. Where this Section differs from these documents, the requirements of this Section shall apply.

A. National Electrical Code (NEC)

1. NEC Article 460—Equipment for General Use – Capacitors.

1.03 WARRANTIES

A. Warranties shall be in accordance with the General Conditions, Supplementary Conditions, and Section 01780, Warranties and Bonds.

B. Unless specified otherwise in the Contract Documents, all equipment supplied under these Specifications shall be warranted by the Contractor and the equipment manufacturers for 1 year. The warranty period shall begin on the date of Owner Final Acceptance.

C. The equipment shall be warranted to be free from defects in workmanship, design, and materials. If any part of the equipment fails during the warranty period, it shall be replaced in the machine(s) and the unit(s) restored to service at no expense to the Owner.

D. The manufacturer’s warranty period shall run concurrently with the Contractor’s warranty or guarantee period. No exception to this provision shall be allowed. The Contractor shall be responsible for obtaining equipment warranties in accordance with Section 01780, Warranties and Bonds, from each of the respective suppliers or manufacturers for all the equipment specified under Divisions 11, Equipment; 15, Mechanical; and 16, Electrical.

E. If the manufacturer is unwilling to provide a 1-year warranty beginning at the time of Owner acceptance, the Contractor shall obtain from the manufacturer a 2-year warranty starting at the time of equipment delivery to the job site. This 2-year warranty shall not relieve the Contractor of the 1-year warranty starting at the time of Owner acceptance of the equipment.

1.04 DELIVERY, STORAGE, AND HANDLING

A. The Contractor shall adhere to the requirements specified in Section 01650, Delivery, Storage, and Handling, for storing and protecting the items specified in this Section.

1.05 INSTALLATION OF EQUIPMENT

A. The Contractor shall take special care to ensure proper alignment of all equipment with particular emphasis on the pumps and electric drives. The units shall be carefully aligned on their foundations by qualified millwrights after the units' sole plates have been shimmed to true alignment at the anchor bolts. The anchor bolts shall be set in place and the nuts tightened against the shims. After the Engineer has approved the foundation alignments, the bedplates or wing feet of the equipment shall be securely bolted in place. The Contractor shall further check the alignment of the equipment after it is secured to the foundations and, after all alignments are conformed, shall grout the sole plates in place. The Contractor shall be responsible for the exact alignment of equipment with associated piping and under no circumstances will pipe springing be allowed.

B. The Contractor shall furnish all wedges, shims, filling pieces, keys, packing, grout, or other materials necessary to properly align, level, and secure apparatus in place. All parts intended to be plumb or level must be proven to be exactly so. The Contractor shall perform all grinding necessary to bring parts to proper bearing after erection.

1.06 SLEEVES AND OPENINGS

A. The Contractor shall provide all openings, channels, chases, etc., in new construction and furnish and install anchor bolts and other items to be embedded in concrete as required to complete the Work under this Contract. The Contractor shall perform all cutting, coring, and rough and finish patching required in existing construction for the work of all trades.

B. Subcontractors shall furnish all sleeves, inserts, hangers, anchor bolts, etc., required for the execution of their work. Before the work of the Contractor begins, the subcontractors shall be responsible for furnishing the Contractor with the above items and with templates, drawings, or written information covering

chases, openings, etc., which they require and to follow up the work of the Contractor as it progresses, making sure that their drawings and written instructions are carried out. If the subcontractors fail to do this, they shall be responsible for the cost of any corrective measures that may be required to provide necessary openings, etc. If the Contractor fails to carry out the directions given him, covering details and locations of openings, etc., he shall be responsible for any cutting and refinishing required to make the necessary corrections. In no case shall beams, lintels, or other structural members be cut without the Engineer's approval.

1.07 GREASE, OIL, AND FUEL

A. The Contractor shall furnish all grease, oil, and fuel required for testing equipment 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 under Divisions 11, Equipment, 15, Mechanical; and 16, Electrical.

1.08 TOOLS

A. The Contractor shall furnish any special tools (including grease guns or other lubricating devices) that may be necessary for the adjustment, operation, and maintenance of any equipment with the respective equipment.

B. Tools shall be furnished in heavy steel toolboxes complete with lock and duplicate keys.

1.09 SPARE PARTS

A. Where spare parts are specified in the Specification Sections, the Contractor shall furnish all spare parts recommended by the manufacturer or system supplier for 1 year of service. In addition, the Contractor shall furnish all spare parts itemized in each Section.

B. The Contractor shall collect and store all spare parts in an area to be designated by the Engineer and shall furnish the Engineer with 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 delivery cost.

C. Spare parts shall be packed in cartons properly labeled with indelible markings with complete descriptive information, including manufacturer, part number, part name, and equipment for which the part is to be used and shall be properly treated for 1 year of storage.

1.10 HURRICANE PREPAREDNESS PLAN

A. Within 30 calendar days of the date of Notice to Proceed, the Contractor shall submit a Hurricane Preparedness Plan to the Owner for approval. The Plan shall describe in detail the necessary measures that the Contractor will perform, at no additional costs to the Owner, in case of a hurricane warning. The Contractor shall revise the Plan as required by the Owner.

1.11 WEATHER PROTECTION

A. In the event of inclement weather, the Contractor shall protect the Work and materials from damage or injury from the weather. If, in the opinion of the Owner, any portion of the Work or materials has been damaged by reason of failure on the part of the Contractor to protect the Work, such Work and materials shall be removed and replaced with new materials and Work to the satisfaction of the Owner.

1.12 PROVISIONS FOR CONTROL OF EROSION

A. The Contractor shall take sufficient precautions during construction to minimize the run-off of polluting substances such as silt, clay, fuels, oils, bitumens, calcium chloride, or other polluting materials harmful to humans, fish, or other life, into the wetlands and surface waters of the State. Control measures must be adequate to ensure that turbidity in the receiving water will not be increased more than 10 nephelometric turbidity units (NTU), or as otherwise required by the State or other controlling body, in water used for public water supply or fish unless limits have been established for the particular water. In surface water used for other purposes, the turbidity must not exceed 25 NTU unless otherwise permitted. Special precautions shall be taken in the use of construction equipment to prevent operations that promote erosion.

1.13 PROVISIONS FOR THE CONTROL OF DUST AND LITTER

A. The Contractor shall take sufficient precautions during construction to minimize the amount of dust created. Wetting down the Site may be required or as directed by the Engineer to prevent dust as a result of vehicular traffic. Control of blowing litter caused by any regrading by the Contractor shall be the responsibility of the Contractor.

1.14 ON-SITE STORAGE

A. The Contractor should note that there may be special storage requirements and possible charges for noncompliance of on-site storage requirements for materials and equipment as specified in Section 01600, Materials and Equipment.

1.15 ELECTRICAL POWER AND TESTING EQUIPMENT

A. The Contractor shall furnish electric power and all equipment and tools required for testing equipment. The cost of this electric power, equipment, and tools shall be included in the prices quoted in the Bid Form.

1.16 PROTECTION AGAINST ELECTROLYSIS

A. Where dissimilar metals are used in conjunction with each other, the Contractor shall provide suitable insulation between adjoining surfaces to eliminate direct contact and any resulting electrolysis. The insulating material shall be bituminous impregnated felt, heavy bituminous coatings, nonmetallic separators or washers, or other approved materials.

1.17 DAMAGE DUE TO HIGH WATER

A. The Contractor will be responsible for all damage done to his work by heavy rains or floods and he shall take all reasonable precautions to provide against damages by building such temporary dikes, channels, or shoring to carry off stormwater as the nature of the work may require.

1.18 EMERGENCY PHONE NUMBERS AND ACCIDENT REPORTS

A. Emergency phone numbers (fire, medical, police) shall be posted at the Contractor’s phone and the phone’s location be made known to all.

B. Accidents shall be reported immediately to the Engineer by phone.

C. The Contractor shall document all accidents and shall submit to the Engineer a fully detailed written report about the accident after each accident.

1.19 ITEMS SPECIFIED ON DRAWINGS

A. Items of material, equipment, machinery, and the like may be specified on the Drawings and not in the Specifications. The Contractor shall provide such items in accordance with the Specification on the Drawings.

1.20 SALVAGE

A. Any existing equipment or material, including but not limited to valves, pipes, fittings, couplings, etc., which is removed or replaced as a result of construction under this project may be designated as salvage by the Engineer or Owner and, if so, shall be excavated, if necessary, and shall be 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. Any equipment or material not worthy of salvaging, as directed by the Owner, shall be disposed of by the Contractor at a suitable location at the Contractor's expense.

1.21 WORKMANSHIP, MATERIAL, AND EQUIPMENT

A. When a particular product or products are specified or called for, the intent is and the understanding shall be that the proposal tendered by the Contractor include those products in his bid. Should the Contractor desire to substitute a product or products equal to those specified, the Contractor shall furnish information as described in the Standard General Conditions. The alternate product or products submitted by the Contractor shall meet the requirements of the Specifications and shall, in all respects, be equal to the product or products specified by name in the Specifications.

B. All apparatus, mechanisms, equipment, machinery, and manufactured articles for incorporation into the Work shall be the new and unused standard products of recognized reputable manufacturers.

1.22 OPERATING AND MAINTENANCE DATA

A. Operating and maintenance data covering all equipment furnished shall be delivered directly to the Engineer for approval within 60 days before the facility's start-up. No payment shall be made for equipment installed or stored on site until the Engineer has approved the adequacy and completeness of the operating and maintenance data. Data shall be prepared and submitted in full conformance with Section 01830, Operations and Maintenance Manuals. Final approved copies of operating and maintenance data shall have been delivered to the Engineer on the Owner's behalf 2 weeks before scheduling the instruction period with the Owner.

1.23 RESPONSIBILITY OF CONTRACTOR

A. The Contractor shall be responsible for the entire Work determined by the Drawings, Specifications, and Contract from the date of the starting of the Work until it is accepted as evidence of approval of the Completion Certificate by the Owner. The Contractor shall be responsible for removals, renewals, and replacements due to action of the elements and all other causes except as

otherwise provided in the Specifications. The Contractor shall keep the Contract under his own control and it shall be his responsibility to see that the Work is properly supervised and carried on faithfully and efficiently. The Contractor shall supervise the work personally or shall have a competent English-speaking superintendent or representative, who shall be on the site of the project at all working hours and who shall be empowered with full authority by the Contractor to direct the performance of the Work and make arrangement for all necessary materials, equipment, and labor without delay.

B. Renewals or repairs required because of defective materials or workmanship or due to the action of the elements or other natural causes, including fire and flood, before the acceptance as determined by the Completion Certificate shall be done in accordance with the Contract and Specifications at the expense of the Contractor.

1.24 CONSTRUCTION CONDITIONS AND SUBSURFACE INVESTIGATION

A. The Contractor shall strictly adhere to the specific requirements of the governmental unit(s) or agency(ies) having jurisdiction over the Work. Wherever a difference in the requirements of a jurisdictional body and these Specifications occurs, the more stringent shall apply.

B. The Contractor shall be responsible for having determined to his satisfaction, before submitting his bid, the nature and location of the Work, the conformation of the ground, the character and quality of the substrata, the types and quantity of materials to be encountered, the nature of the groundwater conditions, the character of equipment and facilities needed before and during the execution of the Work, the general and local conditions, and all other matters which can in any way affect the Work under this Contract. The prices established for the work to be done will reflect all costs pertaining to the Work. Any claims for extras based on substrata, groundwater table, and other such conditions will not be allowed.

1.25 SUSPENSION OF WORK DUE TO WEATHER

A. During inclement weather, all work which might be damaged or rendered inferior by such weather conditions shall be suspended. The orders and decisions of the Engineer regarding suspensions shall be final and binding. The ability to issue such an order shall not be interpreted as a requirement to do so. During suspension of the work from any cause, the Work shall be suitably covered and protected to preserve it from injury by the weather or otherwise, and if the Engineer shall so direct, the rubbish and surplus materials shall be removed.

1.26 PERMITS

A. Upon notice of award, the Contractor shall immediately apply for all applicable permits, including building permits, National Pollutant Discharge Elimination System (NPDES) permits, dewatering permits, and any other required permits not previously obtained by the Engineer to do the Work from the appropriate governmental agency or agencies. No work shall begin until all applicable permits have been obtained and copies delivered to the Owner. The Contractor shall bear all costs for obtaining all permits.

1.27 PUMPING

A. The Contractor with his own equipment shall do all pumping necessary to prevent flotation of any part of the structures during construction operations.

B. For the duration of the Contract and with his own equipment, the Contractor shall pump out water and wastewater that may seep or leak into the excavations or structures.

1.28 OWNER OCCUPANCY AND OPERATION OF COMPLETED FACILITIES

A. The assumption is that portions of the Work will be completed before the entire work is completed. On completion of construction in each individual facility, including testing, if the Owner, at its sole discretion, desires to accept the individual facility, the Contractor will be issued a dated Certificate of Completion and Acceptance for each individual facility. The Owner will assume ownership and begin operation of the individual facility on that date and the 1-year guaranty period shall begin on that date. The Owner has the option of not accepting any individually completed facility, but accepting the entire Work as a whole once completed and tested.

1.29 CLAIMS FOR PROPERTY DAMAGE

A. Upon notification by the Owner or Engineer, the Contractor shall investigate each claim for property damage and shall file, within 10 days of such notification, a statement with the Owner or Engineer setting forth all facts and details relative to the claim.

1.30 DAILY REPORTS

A. The Contractor shall submit daily reports of construction activities, including non-workdays. The report shall include the following:

1. Manpower, number of workers by craft.
2. Equipment on the project.
3. Major deliveries.
4. Activities work with reference to the Critical Path Method (CPM) schedule activity numbers.
5. New problems.
6. Other pertinent information.

B. A similar report shall be submitted for/by each subcontractor.

C. The reports shall be submitted to the Engineer's Field Office within 2 days of the respective report date. Each report shall be signed by the Contractor's Superintendent or Project Manager.

1.31 CONNECTIONS TO EXISTING SYSTEMS

A. The Contractor shall perform all work necessary to locate, excavate, and prepare for connections to the terminus of the existing systems all as shown on the Drawings or where directed by the Engineer. The cost of this work and for the actual connection of the existing mains shall be included in the bid for the Project and shall not result in any additional cost to the Owner or Engineer.

1.32 COORDINATION OF WORK

A. The Contractor shall afford other contractors and the Owner reasonable opportunity for the introduction and storage of their materials and equipment and the execution of their work and shall properly connect and coordinate the Work with such other work. The Contractor shall coordinate his Work with the Owner and other contractors to store his apparatus, materials, supplies, and equipment in such orderly fashion at the site of the Work so that it will not unduly interfere with the progress of the Work or the work of any other contractors.

B. If the execution or result of any part of the Work depends on any work of the Owner or of any separate contractor, the Contractor shall, before proceeding with the Work, inspect and promptly report to the Owner in writing any apparent discrepancies or defects in such work of the Owner or of any separate contractor that render it unsuitable for the proper execution or result of any part of the Work.

C. Failure of the Contractor to inspect and report any deficiencies shall constitute an acceptance of the Owner's or separate contractor's work as fit and proper to receive the Work, except as to defects that may develop in the Owner's or separate contractor's work after completion of the Work, which the Contractor could not have discovered by his inspection before the Work was completed.

D. If the Contractor damages the work or property of the Owner or of any separate contractor on the Project or other work on the Site, or delays or interferes with the Owner's work on ongoing operations or facilities or adjacent facilities or the separate contractor's work, the Contractor shall be liable for damage caused and, in the case of another contractor, the Contractor shall attempt to settle the claim with the other contractor before the other contractor institutes litigation or other proceedings against the Contractor.

E. If a separate contractor sues the Owner on account of any damage, delay, or interference caused or alleged to have been caused by the Contractor, the Owner shall notify the Contractor, who shall defend the Owner in such proceedings at the Contractor's expense. If any judgment or award is entered against the Owner, the Contractor shall satisfy the same and shall reimburse the Owner for all damages, expenses, attorneys' fees, and other costs that the Owner incurs as a result of the judgment or award.

F. If a separate contractor causes damage to the Work or to the property of the Contractor or causes delay or interference with the Contractor's performance of the Work, the Contractor shall present directly to the separate contractor any claims it may have as a result of such damage, delay, or interference (with an information copy to the Owner) and shall attempt to settle its claim against the separate contractor before instituting litigation or other proceedings against the separate contractor.

G. In no event shall the Contractor seek to recover from the Owner or the Engineer, and the Contractor hereby represents to the Owner and the Engineer that he will not seek to recover from them, or either of them, any costs, expenses, (including, but not limited to, attorneys' fees) or losses of profit incurred by the Contractor as a result of any damage to the Work or property of the Contractor or any delay or interference caused or allegedly caused by any separate contractor.

H. The Engineer shall determine and adjust any difference or conflict that may arise between the Contractor and other contractors who may be performing work on behalf of the Owner or between the Contractor and workmen of the Owner regarding their work. If the work of the Contractor is delayed because of any acts or omissions of any other contractor of the Owner, the Contractor shall on that account have no claim against the Owner other than for an extension of time.

1.33 FINAL GUARANTEE

A. The Contractor shall guarantee all work for 1 year from the date of Final Acceptance of the Work by the Owner.

B. If, within the guarantee period, repairs or changes are required in connection with guaranteed work, which, in the opinion of the Engineer, are rendered necessary as the result of the use of materials, equipment, or workmanship which are inferior, defective, or not in accordance with the terms of the Contract, the Contractor shall do the following promptly upon receipt of notice from the Owner and without expense to the Owner:

1. Place in satisfactory condition in every way all such guaranteed work and correct all defects in the guaranteed work.
2. Make good all damage to the building or site, or equipment or piping, or their contents, which, in the opinion of the Engineer, is the result of the use of materials, equipment, or workmanship which are inferior, defective, or not in accordance with the terms of the Contract.
3. Make good any work or material or the equipment and contents of the building, structure, or site disturbed in fulfilling any such guarantee.

C. If the Contractor, after notice, fails to proceed to comply with the terms of this guarantee within 10 days, the Owner may have the defects corrected and the Contractor and his surety shall be liable for all expenses incurred provided. However, that in case of an emergency where, in the opinion of the Owner, delay would cause loss or damage, repairs may be started without notice being given to the Contractor and the Contractor shall pay the cost of such repairs.

D. All special guarantees or warranties applicable to specific parts of the Work as may be stipulated in the Contract Specifications or other papers forming a part of this Contract shall be subject to the terms of this Paragraph during the first year of life of each such guarantee. The Contractor shall assemble all special guarantees and manufacturers' warranties, along with a summary list of the special guarantees and warranties, and deliver these to the Engineer before the Work is accepted.

1.34 AUTOMATICALLY CONTROLLED EQUIPMENT

A. Whenever batching or mixing plant equipment is required to be operated automatically under the Contract and a breakdown or malfunction of the automatic controls occurs, the equipment may be operated manually or by other methods for 48 hours after the breakdown or malfunction, provided this method of operation will produce results otherwise meeting the Specifications.

1.35 EQUIPMENT DATA FORMS

A. The Contractor shall obtain, prepare, and submit a complete, detailed listing of equipment and motor data for all electrical items furnished under this Contract. This listing shall be submitted with the preliminary draft of Operations and Maintenance Data Manuals on Equipment Data sheets and the Equipment Manufacturer's Certificate of Installation, Testing, and Instruction and the Manufacturer's Certificate of Compliance forms, which are included at the end of Section 11000, General Equipment Requirements.

1.36 RIGHTS IN AND USE OF MATERIALS FOUND ON THE WORK

A. With the Engineer's approval, the Contractor may use on the project such stone, gravel, sand, or other material determined suitable by the Engineer as may be found in the excavation. The Contractor shall replace at his own expense, with other acceptable material, all of that portion of the excavation materials so removed and used that were needed for use in the embankments, backfills, approaches, or otherwise. No charge for the materials used will be made against the Contractor.

1.37 OWNER-FURNISHED MATERIAL

A. The Contractor shall furnish all materials required to complete the Work. No materials will be furnished by the Owner.

1.38 MAINTENANCE AND LUBRICATION SCHEDULES

A. The Contractor's attention is directed to Section 01830, Operations and Maintenance Manuals, for requirements relative to the submittal of operating and maintenance data for the mechanical equipment. For all mechanical and electrical equipment furnished, the Contractor shall provide a list including the equipment name, address, and telephone number of the manufacturer's representative and service company so that service and/or spare parts can be readily obtained.

1.39 INSTALLATION LISTS

A. All manufacturers or equipment suppliers who propose to furnish equipment or products under Divisions 11, Equipment; 15, Mechanical; and 16, Electrical; shall submit an installation list to the Engineer along with the required Shop Drawings.

B. The installation list shall include all installation where identical equipment has been installed and has been in operation for at least 1 year.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01450
TESTING AND TESTING LABORATORY SERVICES

PART 1 GENERAL

1.01 SCOPE OF WORK

A. The Contractor will pay for the costs of all laboratory tests required to determine items such as soil density, concrete/grout compressive strength, and other testing, where appropriate, to determine compliance with the Contract Documents. All required testing shall be coordinated and scheduled by the Contractor.

1. The Contractor shall cooperate with the laboratory to facilitate the execution of required services.
2. The Owner shall approve the selection of the testing laboratory.
3. Employment of a testing laboratory shall in no way relieve the Contractor of the obligation to perform work in accordance with the requirements of the Contract Documents.

1.02 RELATED WORK

A. Conditions of the Contract: Inspections and testing required by laws, ordinances, rules, regulations, orders, or approvals of public authorities.

B. Respective Sections

1. Certification of products.
2. Laboratory tests required and standards for testing.

C. Each Section listed: Laboratory tests required and standards for testing.

D. Testing laboratory inspection, sampling, and testing are required for but are not limited to the following:

1. Article IV, Sections 201, 304, 307, 405, 506, and all other sections referencing testing laboratory services in the City of Clearwater Standard Technical Specifications.

1.03 SUBMITTALS

A. The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance.

B. Submit to the Engineer for review a list and schedule of all tests to be conducted.

C. Describe test procedures along with the duration of tests.

D. After each inspection and test, the Laboratory shall promptly submit two copies of the laboratory report to the Engineer, one copy to the Contractor, and one copy to the Owner.

E. Include the following:

1. Date issued.
2. Project title and number.
3. Name of field testing technician or inspector.
4. Date and time of sampling or inspection.
5. Identification of product and Specifications Section.
6. Location in the Project.
7. Type of inspection or test.
8. Date of test.
9. Results of test.
10. Conformance with Contract Documents.

F. When requested by the Engineer, provide interpretation of test results.

1.04 QUALITY ASSURANCE

A. The Laboratory is not authorized to do any of the following:

1. Release, revoke, alter, or enlarge on requirements of Contract Documents.
2. Approve or accept any portion of the Work.
3. Perform any duties of the Engineer of Record or the Engineer.

B. The Contractor shall be responsible for the following:

1. Cooperating with laboratory personnel, providing access to work and to manufacturer's operations.

2. Securing and delivering to the laboratory adequate quantities of representative samples of materials proposed to be used and that require testing.

3. Providing to the laboratory the preliminary design mix proposed to be used for concrete and other materials mixes that require control by the testing laboratory.

4. Furnishing incidental labor and facilities:

   a. To provide access to Work to be tested.
   b. To obtain and handle samples at the project site or at the source of the product to be tested.
   c. To facilitate inspections and tests.
   d. To store and cure test samples.

5. Notifying the Engineer and laboratory sufficiently in advance of operations to allow the laboratory time to assign personnel and schedule tests.

6. Employing and paying for the services of the same or a separate, equally qualified independent testing laboratory to perform additional inspections, sampling, and testing required for the Equipment Supplier or Contractor's (as applicable) convenience.

C. Materials and equipment used in the performance of Work under this Contract are subject to inspection and testing at the point of manufacture or fabrication. Standard requirements for quality and workmanship are indicated in the Contract Documents. The Engineer may require the equipment supplier or Contractor (as applicable) to provide statements or certificates from the manufacturers and fabricators that the materials and equipment provided by them are manufactured or fabricated in full accordance with the standard specifications for quality and workmanship indicated in the Contract Documents. All costs of this testing and providing statements and certificates shall be a subsidiary obligation of the Contractor, and no extra charge to the Owner shall be allowed on account of such testing and certification.

D. If the test and any subsequent retest results indicate that the materials or equipment fail to meet the requirements of the Contract Documents, the equipment supplier or Contractor (as applicable) shall pay for the laboratory costs directly to the testing firm and these will not be reimbursable to the equipment supplier or Contractor (as applicable).

1.05 QUALIFICATIONS

A. Laboratory: Licensed to operate in Florida.

B. Laboratory Staff: Maintain a full-time Florida-registered Professional Engineer on staff to review the services performed under this project.

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

D. Provide qualified personnel at the site. Cooperate with the Engineer and Contractor in performing services.

E. Perform specified inspection, sampling, and testing of products in accordance with specified standards.

F. Ascertain compliance of materials and mixes with requirements of Contract Documents.

G. Promptly notify the Engineer and Contractor of observed irregularities or non-conformance of Work or Products.

H. Perform additional inspections and tests required by Engineer.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01500
TEMPORARY FACILITIES AND CONTROLS

PART 1 GENERAL

1.01 RESPONSIBILITY

A. This Section specifies the minimum requirements for temporary facilities, utilities, and controls required to provide an adequate and safe work site at every stage during construction of the Project. The Contractor is solely responsible for the requirements set forth in this Section.

1.02 ONSITE TEMPORARY

A. Except as otherwise indicated, the Contractor may, at his option, furnish stand-alone utility plants to provide needed services in lieu of connected services from available public utilities, provided such stand-alone plant facilities comply with all governing regulations. Before availability of temporary utility services, the Contractor will provide trucked-in/trucked-out containerized or unitized services for start-up of construction operations at the site.

1.03 COSTS

A. Except as otherwise indicated, the costs of providing and using temporary utility services are included in the contract sum.

1.04 TEMPORARY FACILITIES

A. The types of utility services required for temporary use at the project site include the following (other specific services may be required for specific construction methods of operations):

1. Electrical Power Service.
2. Sanitary.
3. Gas (fuel) Service.

1.05 TEMPORARY ELECTRICITY

A. The Contractor shall make the necessary applications and arrangements and pay all fees and charges for electrical energy for power and light necessary for proper completion of the Work and during its entire progress up to time of final acceptance by the Owner. The Contractor shall provide and pay for all temporary switches, connections, and meters.

1.06 TEMPORARY SANITARY FACILITIES

A. The Contractor shall provide adequate sanitary facilities for the use of those employed on the Work. Such facilities shall be made available when the first employees arrive on the site of the Work, shall be properly secluded from public observation, and shall be constructed and maintained during the progress of the Work in suitable numbers and at such points and in such manner as may be required or approved.

1.07 CLEANLINESS OF FACILITIES

A. The Contractor shall maintain the sanitary facilities in a satisfactory and sanitary condition at all times and shall enforce their use. He shall rigorously prohibit the committing of nuisances on the site of the Work, on the lands of the Owner, or on adjacent property.

1.08 TERMINATION AND REMOVAL

A. At the time the need for a temporary utility service has ended or has been replaced by use of permanent services, or no later than the time of final completion, the Contractor shall promptly remove the installation unless requested by the Engineer to retain it for a longer period. Any work that may have been delayed or affected by the installation and use of the temporary utility, including repairs to construction and grades and restoration and cleaning of exposed surfaces, shall be completed at this time. The Contractor shall replace any work damaged beyond acceptable restoration.

1.09 NOISE CONTROL

A. The Contractor shall provide adequate protection against objectionable noise levels caused by the operation of construction equipment.

1.10 DUST CONTROL

A. The Contractor shall provide for adequate protection against raising objectionable dust clouds caused by moving construction equipment, high winds, or any other cause.

1.11 WATER CONTROL

A. The Contractor shall provide for satisfactory disposal of surplus water and shall submit a plan to the Engineer for review before initiating and implementing the

plan. Approval shall be obtained from the proper authorities before the use of public or private lands or facilities for such disposal.

1.12 POLLUTION CONTROL

A. The Contractor shall provide for adequate protection against polluting any public or private lands, lakes, ponds, rivers, streams, creeks, and other such areas by the disposal of surplus material in the form of solids, liquids, gases, or from any other cause.

1.13 ADVERSE IMPACT

A. The Contractor shall evaluate and assess the impact of any adverse effects on the natural environment that may result from construction operations and shall operate to minimize pollution of air, ground, or surface waters vegetation, and afford the neighboring community the maximum protection during and up to completion of the construction project.

1.14 STREAMS, LAKES, AND OTHER BODIES OF WATER

A. The Contractor shall take sufficient precautions to prevent pollution of streams, lakes, and reservoirs with fuels, oils, bitumens, calcium chloride, or other harmful materials. He shall conduct and schedule his operations to avoid or otherwise prevent pollution of siltation of streams, lakes, and reservoirs and to avoid interference with the movements of migratory fish.

1.15 CHEMICALS

A. All chemicals used during project construction or furnished for project operation, whether herbicide, pesticide, disinfectant, polymer, reactant, or of other classification, must show approval of either EPA or USDA. Use of all such chemicals and disposal of residues shall be in strict conformance with instructions.

1.16 EROSION CONTROL

A. The Contractor shall not expose by construction operations a larger area of erosive land at any one time than the minimum necessary for efficient construction operations, and the duration of exposure of the uncompleted construction to the elements shall be as short as practicable. Erosion-control features shall be constructed concurrently with other work and at the earliest practicable time.

1.17 STORAGE FACILITIES

A. All products, materials, and equipment shall be stored in accordance with the manufacturer's instructions, with seals and labels intact and legible. Products subject to damage by the elements shall be stored in weathertight enclosures. Temperature and humidity shall be maintained within the ranges required by the manufacturer's instructions. Fabricated products shall be stored above the ground on blocking or skids. Products that are subject to deterioration shall be covered with impervious coatings with adequate ventilation to avoid condensation. Loose granular materials shall be stored in a well-drained area on solid surfaces to prevent mixing with foreign matter. Any products that will come in contact with water shall be stored off the ground to prevent contamination.

1.18 INSPECTION

A. Storage shall be arranged in such a manner to provide easy access for inspection. Periodic inspections shall be made of all stored products to ensure that they are maintained under specified conditions and free from damage or deterioration.

1.19 TEMPORARY PROTECTION

A. After installation, the Contractor shall provide substantial coverings as necessary to installed products to protect them from damage from traffic and subsequent construction operations. Coverings shall be removed when no longer needed.

1.20 ADJACENT TO WORK

A. The Contractor shall protect from damage all property along the line of the Work or in the vicinity of or in any way affected by the Work, the removal or destruction of which is not called for by the Drawings. Wherever such property is damaged due to the activities of the Contractor, it shall be immediately restored to its original condition by the Contractor at no cost to the Owner.

1.21 REMEDY BY OWNER

A. In case of failure on the part of the Contractor to restore such property or make good such damage or injury, the Owner may, after 48 hours’ notice to the Contractor, proceed to repair, rebuild, or otherwise restore such property as may be deemed necessary and the cost of such repairs, rebuilding, or restoration will be deducted from any monies due or which may become due to the Contractor under this Contract.

1.22 PROTECTION FROM DAMAGE

A. The Contractor shall be responsible for protecting property in the areas in the vicinity of the Project and for protecting his equipment, supplies, materials, and work against any damage resulting from the elements, such as flooding, rainstorm, wind damage, or other such damage, and shall be responsible for damage resulting from the same. The Contractor shall provide adequate drainage facilities, tie-downs, or other protection throughout the contract period for the protection of his, the Owner's, and other properties from such damage.

1.23 TRAFFIC REGULATION

A. Signs, marking barricades, and procedures shall conform to the requirements of the Florida Department of Transportation Manual on Traffic Controls and Safe Practices for Street and Highway Construction, Maintenance, and Utility Operations.

1.24 SIGNAGE

A. The Contractor shall provide and maintain adequate barricades around open excavations.

1.25 REMOVAL OF SIGNAGE

A. On completion of the Work, the Contractor shall remove all debris, excess materials, barricades, and temporary work, leaving walkways and roads clear of obstructions.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01600
MATERIALS AND EQUIPMENT

PART 1 GENERAL

1.01 SCOPE OF WORK

This Section includes the minimum requirements for the furnished materials and equipment for this project. The more stringent requirements in the Technical Specification Sections shall take precedence over these requirements for any conflicts.

A. Materials and equipment furnished by the Contractor shall be new and shall not have been in service at any other installation unless otherwise approved. They shall conform to applicable specifications approved in writing by the Engineer.

B. Manufactured and fabricated products shall be designed, fabricated, and assembled in accordance with the best engineering and shop practices. Like parts of duplicate units shall be manufactured to standard sizes and gauges so as to be interchangeable.

C. Quantities of items that are identical shall be by the same manufacturer, regardless of the Design Package breakdown.

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

E. Materials and equipment shall not be used for any purpose other than that for which they are designed or specified.

F. Where materials or equipment are specifically shown or specified to be reused in the Work, special care shall be used in removing, handling, storing, and reinstalling to ensure their proper function in the completed Work.

G. Material and equipment incorporated into the Work:

1. Shall conform to applicable specifications and standards.

2. Shall comply with size, make, type, and quality specified or as specifically approved in writing by the Engineer.

3. Manufactured and fabricated products:

a. Rotating machinery shall be designed and fabricated to provide satisfactory operation without excessive wear and without excessive maintenance during its operating life. Rotating parts shall be statically and dynamically balanced and shall operate without excessive vibration.

1.02 ACCEPTANCE OF MATERIAL AND EQUIPMENT

A. Only new materials and equipment shall be incorporated in the Work. All materials and equipment furnished by the Contractor shall be subject to the inspection and acceptance of the Engineer. No material shall be delivered to the site that does not meet the Contract Specifications.

B. The Contractor shall submit data and samples sufficiently early to permit consideration and acceptance before materials are necessary for incorporating in the work. Any delay of acceptance resulting from the Contractor's failure to submit samples or data promptly shall not be used as a basis of claim against the Owner.

C. The materials and equipment used in the Work shall correspond to the approved samples or other data.

D. If requested, the Contractor shall be required to submit to the Engineer ample evidence that each and every part of the materials, machinery, and equipment to be furnished is of a reliable make and of a type that has been in successful operation within the continental United States. No equipment will be considered unless the manufacturer has designed and manufactured equipment of a comparable type and size for at least 3 years. The Owner will not allow any experimental or untried type of material or machinery to be installed.

E. The equipment specified shall be carefully designed and installed to ensure that it adequately performs all required functions within the specified degree of precision. Each unit shall operate with each of the other parts of the equipment to provide a completely integrated system that shall operate to the satisfaction of the Owner.

F. All equipment, machinery, parts, and assemblies of equipment, machinery, or parts entering into the Work shall be tested as specified. Unless waived in writing by the Engineer, all field and operating tests shall be made in the presence of the Engineer or the Engineer's authorized representative. When such a waiver is issued, the Contractor or manufacturer shall furnish sworn statements in duplicate of the tests conducted and the results of the tests to the Engineer.

G. The Contractor shall submit copies of welding procedures for all welding. Welders and welding operators shall be selected in accordance with the qualification requirements of the AWS Code. Welders and welding operators for stainless steel shall pass qualification tests using stainless steel filler metal and procedures developed for stainless steel. Procedures, welder, and operator qualifications shall be certified by an independent testing laboratory retained and paid by the Contractor.

H. The Contractor shall not start fabrication of the Work until the Contractor receives written acceptance of the proof of welding procedures from the Owner for each type of weld.

I. The Contractor shall submit copies of mill certificate for each type of rolled steel and as required in the Specifications. The Contractor shall not start fabrication of the work until the Contractor receives written acceptance of all mill certificates from the Owner.

1.03 MANUFACTURER'S INSTRUCTIONS FOR INSTALLATION

A. The equipment installation details shall suit the existing and furnished equipment and are subject to acceptance by the Owner.

B. Any changes or revisions made necessary by the type and dimensions of the equipment furnished shall be made at the expense of the Contractor who shall furnish detailed drawings showing such changes or revision for the acceptance of the Owner.

C. The installation of all work shall comply with the manufacturer’s printed instructions. The Contractor shall obtain and distribute copies of such instructions to parties involved in the installation, including six copies to the Engineer for distribution. One complete set of instructions shall be maintained at the job site during installation and until the Project is complete.

D. All products and equipment shall be handled, installed, connected, cleaned, conditioned, and adjusted in accordance with the manufacturer’s instructions and specified requirements. Should job conditions or specified requirements conflict with the manufacturer’s instructions, such conflicts shall be called to the Owner’s attention for resolution and revised instructions.

E. The Contractor shall perform work according to the manufacturer's instructions and not omit any preparatory step or installation procedure unless the instructions are specifically modified or the step or procedure exempted by the Contract Documents.

1.04 INSTALLATION OF EQUIPMENT

A. General: The Contractor shall install the equipment in accordance with the manufacturer's instructions and recommendations and approved submittals at the locations shown on the Drawings. If the equipment locations shown on the Drawings are in conflict with the manufacturer's recommendations or will interfere with the installation or operation of any other item indicated in the Contract Documents, the Contractor shall relocate this equipment and provide the necessary appurtenances to install the equipment in accordance with the manufacturer's recommendations at no additional cost to the Owner. The Contractor shall not install any equipment at locations not in accordance with the Contract Documents or approved submittals.

B. The Contractor shall take special care to ensure proper alignment of all equipment including water control gates, pumping stations, water control structures, and appurtenances. The units shall be carefully aligned on their foundations by qualified millwrights after the units' sole plates have been shimmed to true alignment at the anchor bolts. The anchor bolts shall be set in place and the nuts tightened against the shims. After the Manufacturer's Representative has approved the foundation alignments, the bedplates or wing feet of the equipment shall be securely bolted in place. The Contractor shall further check the alignment of the equipment after it is secured to the foundations and, after all alignments are confirmed, shall finally grout the sole plates in place. The Contractor shall be responsible for the exact alignment of equipment with associated piping and under no circumstances will "pipe springing" be allowed.

C. The Contractor shall install equipment, slabs, walls level and plumb, parallel, and perpendicular to other building and components in exposed interior spaces, unless otherwise shown on the Drawings.

D. The Contractor shall apply an anti-seize compound to threaded fasteners of equipment components that require removal, replacement, or adjustment as part of any maintenance or inspection procedure.

E. The Contractor shall furnish and install the required oil and grease for initial operation in accordance with the manufacturer's recommendations.

F. The Contractor shall provide means of oil lubrication for bearings and other metallic parts in sliding contact. Use alemite industrial-type fittings except where otherwise specified. The Contractor shall also perform the following work:

1. Locate lubrication points on equipment readily accessible without the necessity of removing covers, plates, housings, or guards, or without creating safety hazards at installed equipment elevations.
2. Exhaust pressure-lubricated units to the atmosphere to prevent excessive greasing.
3. Extend grease fittings to locations that are readily accessible to the Owner. The Contractor shall coordinate the location of these grease fittings with the Owner before their installation.

G. The Contractor shall furnish and apply touch-up paint to any equipment's factory painting finish that is chipped or damaged during installation. All factory-finish touch-up paint shall be mutually compatible with the factory finish on the equipment and shall be furnished by the manufacturer of the equipment to be touched up in the field.

H. If equipment mounting heights are not shown on the Drawings, the Contractor shall install that piece of equipment to provide the maximum amount of headroom (defined as the distance from the bottom of the structure to the top of finished floor or grade) as possible. In such an instance, the Contractor shall obtain the Owner's approval for this mounting location before installing that piece of equipment in the field.

I. The Contractor shall furnish and install all mechanical equipment to facilitate service, maintenance, and repair or replacement of the equipment components. The Contractor shall connect equipment for ease of disconnecting, with minimum interference to other installations.

J. A certificate from the manufacturer stating that the installation of the equipment is satisfactory, that the unit has been satisfactorily tested, is ready for operation, and that the operating personnel have been suitably instructed in the operation, lubrication, and care of the unit shall be submitted before Substantial Completion.

K. The Contractor shall furnish the service of competent manufacturers' representatives for Contractor- or Owner-furnished equipment when evident malfunction or over-heating makes such services necessary or as determined by the Owner. All such equipment shall be installed by skilled mechanics and in accordance with the instructions of the manufacturer.

L. The Contractor shall furnish all wedges, shims, filling pieces, keys, packing, grout, or other materials necessary to properly align, level, and secure an

apparatus in place. All parts intended to be plumb or level must be proven exactly so. Any grinding necessary to bring parts to proper alignment after erection shall be done at the expense of the Contractor.

M. The Contractor shall furnish the necessary materials and construct suitable concrete foundations or pads for all equipment installed by the Contractor, even though such foundations or pads may not be indicated on the Drawings. The tops of foundations shall be at such elevations as will permit grouting.

1.05 LUBRICATION SYSTEM

A. The minimum design criteria for lubricating moving parts of the equipment shall include 1 week of continuous operation during which no lubricants shall be added to the system.

B. The system shall be designed to receive lubricants whether in operation or shut down and shall not leak or waste lubricants under either condition. The manufacturer's recommendations of grade and quality and a supply of the lubricants so recommended in quantities sufficient to conduct start-up and testing operations shall be furnished with the equipment.

1.06 SPECIAL TOOLS

A. Manufacturers of equipment and machinery shall furnish two sets of any special tools (including grease guns or other lubricating devices) required for normal adjustment, operations and maintenance, and disassembly, together with instructions for their use. The Contractor shall preserve and deliver to the Owner these tools and instructions in good order before completing the Contract. Tools shall be high-grade, smooth, forged, alloy tool steel. Grease guns shall be lever-type.

B. Special tools are considered to be those tools which because of their limited use are not normally available, but which are necessary for the particular equipment.

C. Special tools shall be delivered at the same time as the equipment to which they pertain. The Contractor shall properly store and safeguard such special tools until completion of the work, at which time they shall be delivered to the Owner.

1.07 TESTS AND TEST REPORTS

A. When used in the Contract Documents, "Factory/Fabricating Shop Performance, Evaluation, Certification, and/or Acceptance Tests and Test Reports" shall be considered to mean the corresponding manufacturer’s, fabricator’s, and/or other builder’s official tests and test reports. Included in these test reports shall be

appropriate substantiating documentation/data ascertaining the correct and complete manufacture, fabrication, and "shop performance" (to the greatest extent normally practicable) of the particular material, equipment, system, and/or facilities proposed for eventual delivery. These are subdivided into three significant tests and test report types: 1) Certification Tests and Test Reports, 2) Factory Tests and Test Reports, and 3) Shop Performance/Evaluation Tests and Test Reports. Minimal requirements are described below.

B. Certification Tests and Test Reports

1. Standard specifications, code references, etc. for minimum quality and workmanship levels are indicated in the Contract Documents and Construction Documents. Statements, certificates, and other substantiating reporting data, called "Certification Test Reports" in this Section, of tests conducted on previously manufactured materials or equipment identical to that proposed for use shall be compiled by the Contractor.
2. At a minimum all Certification Test Reports shall contain an official analysis of sufficient material composition or show evidence of meeting or exceeding the specified material standard(s) referenced, e.g., ASTM, ASME, or other designations. All reports shall also indicate from whom the material was/will be purchased.
3. The Contractor shall pay all costs of certification tests and test reports.

C. Factory Tests and Test Reports

1. Additional tests and reports performed on material or equipment by the manufacturer or fabricator to ascertain quality or workmanship are referred to here as "Factory Tests and Test Reports."
2. Before the delivery of any Factory Test Report, the Contractor shall first submit for review and approval a detailed description of the proposed testing, including reporting procedure and criteria. Such descriptions shall also be delivered to the Owner for review as part of the first submission of the technical submittal.
3. Materials and equipment used in the performance of the Work under this Contract are subject to inspection and testing at the point of manufacture or fabrication. If Work to be accomplished away from the construction site is to be inspected on behalf of the Owner during its fabrication or manufacture, the Contractor shall give prior notice to the Engineer of the place and time where such fabrication or manufacture is to be done. Such notice shall be in writing and delivered to the Engineer not less than 30 days before the Work is to be done so that the necessary arrangements for the particular factory inspection tests can be made.
4. Upon completion of the factory inspection tests and immediately following manufacture or fabrication, the Contractor shall compile a

complete Factory Test Report following the approved format above. All such reports shall be delivered to the Owner for review as part of the technical submittal corresponding to such tested material or equipment.

D. Shop Performance/Evaluation Tests and Tests Reports

1. Material and equipment used in the performance of the Work of this Contract are also subject to evaluation and testing after the complete full-scale assembly into major equipment and/or systems. Shop Performance/Evaluation Tests, i.e., tests of simulated startup, steady-state, variable loading, and other normal operating conditions, for such assembled equipment/systems shall be accomplished in strict accordance with the standard testing practices specified or otherwise accepted by the Engineer.
2. Before the delivery of any Shop Performance/Evaluation Test Report, the Contractor shall submit for review a detailed description of the proposed performance/evaluation tests, including anticipated reporting procedures, data reduction, and criteria used. Where appropriate, such descriptions shall also be delivered to the Engineer for review as part of a first or subsequent submission of the technical submittal.
3. Should such performance/evaluation tests be accomplished away from the construction site, the Contractor shall give prior notice to the Owner of the places and times where such tests will be accomplished. Such prior notice shall be in writing and delivered not less than 30 days before such events so that necessary arrangements for the particular tests can be made.
4. The requirements above pertaining to Factory Tests and Test Reports shall be incorporated for shop Performance/Evaluation Tests and Test Reports. Unless factory tests are coincident with shop performance tests and vice versa for the same material or equipment, a minimum of 15 days shall be scheduled between such multiple equipment tests where extended travel is required.

E. Cost of Performance Shop Tests

1. The Contractor shall conduct shop performance full-scale tests at its expense on all equipment as specified. Each piece of equipment shall be tested completely assembled and the shop tests performed by the equipment manufacturer until successful tests are achieved.
2. If the performance tests are conducted outside the continental United States, the Contractor shall pay all transportation expenses incurred by the Owner’s representatives in witnessing the tests at no additional cost to the Owner.

1.08 FIELD TESTING

A. Field-testing shall be conducted when called for in the Technical Specification Sections and on all completed systems in general. The Contractor shall provide services of a factory-authorized service representative to perform, approve, and certify the field testing specified in this Section. Field testing shall generally consist of performing the pre-startup and startup tests as specified in the Division 11 Specifications. The Contract Documents may require the Contractor to perform factory testing on equipment items before the Owner approves their use for this project. The Contractor shall refer to the Division 11 Specifications regarding equipment shop testing requirements.

B. After completing the installation, the Contractor shall test the system in the presence of the Owner and under actual operating conditions. Tests shall be performed according to the manufacturer's recommendations.

C. The Contractor shall include with its bid the services of the equipment manufacturer's field service technician for a period necessary to complete the Work to the satisfaction of the Engineer and the Owner.

D. This service shall be for the purposes of checkout, initial start-up, certification, and instruction of facilities personnel.

E. A written report covering the technician's findings and installation approval shall be submitted to the Engineer covering all inspections and outlining in detail any deficiencies noted.

1.09 ACCEPTANCE OF INSTALLATION

A. The Engineer may accept an equipment system installation as ready for Substantial Completion when:

1. The Engineer has accepted all factory tests and all other component testing.
2. The Engineer has accepted all performance shop tests.
3. All components of the system are installed and tested, including without limitation hydrostatic tests, leak tests, continuity tests, insulation resistance tests, phase rotation tests, bump tests, stroke testing, calibration, adjustment for proper operation, and all other component tests as appropriate.
4. Field start-up activities have been completed and approved by the Engineer.
5. The appropriate certificates have been submitted.
6. All equipment has met the performance requirements.

7. The Engineer has accepted integrated system tests and adjustments performed by the Contractor to demonstrate that the system as a whole functions reliably and meets the performance requirements, in manual and automatic modes, without failure, fault, or defect of any component or of the system as a whole.
8. The Engineer has accepted integrated facilities tests performed by the Contractor to demonstrate that the entire Construction functions together reliably as an integrated facility and meets the performance requirements, in manual and automatic modes, without failure, fault, or defect of any component.
9. The Engineer has accepted facilities performance tests which demonstrate that the design criteria and performance criteria are met.
10. The Engineer has accepted the O&M Manuals.
11. All required Owner personnel have been trained.
12. All other Contract requirements for Substantial Completion have been satisfied.

1.10 GREASE, OIL, AND FUEL

A. All grease, oil, and fuel required for start-up and testing of equipment shall be furnished with the respective equipment.

B. The Contractor shall be responsible for changing the oil in all drives and intermediate drives of mechanical equipment no greater than 30 days after initial break-in of the equipment.

1.11 ELECTRICAL EQUIPMENT ENCLOSURES

A. All items of electrical equipment that are furnished with process, heating, ventilating, or other equipment shall conform to the requirements specified under the appropriate Electrical Sections of the Specifications. Enclosures for electrical equipment, such as switches and starters, shall conform to the requirements specified under the appropriate Electrical Sections of the Specifications.

1.12 EQUIPMENT DRIVE GUARDS

A. Screens, guards, or cages shall be provided for all exposed rotating or moving parts in accordance with accepted practices of applicable governmental agencies. Unless specified otherwise in the Technical Specifications Sections, guards shall be constructed of galvanized sheet steel or galvanized woven wires or expanded metal set in a frame of galvanized steel members. Guards shall be secured in position by steel braces or straps that will permit easy removal for servicing the equipment.

1.13 PROTECTION AGAINST ELECTROLYSIS

A. Where dissimilar metals are used in conjunction with each other, suitable insulation shall be provided between adjoining surfaces so as to eliminate direct contact and any resultant electrolysis. The insulation shall be bituminous-impregnated felt, heavy -bituminous coatings, nonmetallic separators or washers, or other acceptable materials.

1.14 CONCRETE INSERTS

A. Concrete inserts for hangers 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 for hangers 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.

1.15 SLEEVES AND OPENINGS

A. The Contractor shall provide all openings, channels, chases, etc., in new construction and furnish and install anchor bolts and other items to be embedded in concrete, as required to complete the Work under this Contract. The Contractor shall perform all cutting, coring, and rough and finish patching required in existing construction for the work of all trades.

B. Subcontractors shall furnish all sleeves, inserts, hangers, anchor bolts, etc., required for the execution of their work. Before the work of the Contractor begins, the subcontractors shall be responsible for furnishing the Contractor with the above items and with templates, drawings, or written information covering chases, openings, etc., which they require and to follow up the work of the Contractor as it progresses, making sure that their drawings and written instructions are carried out. If the subcontractors fail to do this, they shall be responsible for the cost of any corrective measures that may be required to provide necessary openings, etc. If the Contractor fails to carry out the directions given him, covering details and locations of openings, etc., he/she shall be responsible for any cutting and refinishing required to make the necessary corrections. In no case shall beams, lintels, or other structural members be cut without the approval of the Owner.

C. Unless otherwise indicated on the Drawings or specified, openings for the passage of pipes through floors and walls shall be formed of sleeves of standard-weight, galvanized-steel pipe. Each sleeve shall be of 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 the slabs and to

project 2 inches above the finished floor surface. Threaded nipples shall not be used as sleeves.

D. Sleeves in exterior walls below ground or in walls to have liquids on one or both sides shall have a 2-inch annular fin of 1/4-inch plate welded with a continuous weld completely around the sleeve at about mid-length. Sleeves shall be galvanized after the fins are attached.

E. All sleeves shall be set accurately before the concrete is placed or shall be built-in accurately as the masonry is being built.

1.16 SERVICES OF MANUFACTURERS' FIELD SERVICE TECHNICIAN

A. Bid prices of equipment furnished shall include the cost of a competent field service technician of the manufacturers of all equipment to supervise the installation, adjustment, and testing of the equipment and to instruct the Owner's operating personnel on operation and maintenance as specified in Section 11000, General Equipment Requirements. The approved manufacturer's operation and maintenance data as specified in Section 01830, Operations and Maintenance Manuals, shall be delivered to the Owner before instructing the Owner's personnel. This supervision may be divided into two or more periods as required by the installation program or as directed by the Owner.

B. After the equipment has been installed and the equipment is presumably ready for operation, but before it is operated by others, the manufacturers' field service technician shall inspect, operate, test, and adjust the equipment. The inspection shall include at least the following points where applicable:

1. Soundness (without cracked or otherwise damaged parts).
2. Completeness in all details, as specified and required.
3. Correctness of setting, alignment, and relative arrangement of various parts.
4. Adequacy and correctness of packing, sealing, and lubricants.
5. Calibration and adjustment of all related instrumentation and controls.
6. Energize equipment.
7. Deficiency correction.
8. Demonstration of compliance with application performance specification.

C. The operation, testing, and adjustment shall be as required to prove that the equipment has been left in proper condition for satisfactory operation under the conditions specified.

D. Upon completion of this operation, testing, and adjustment, the manufacturers' field service technician shall submit to the Owner, in triplicate, a complete, signed

report of the results of the 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 suggestions for precautions to be taken to ensure proper maintenance.

E. Each equipment manufacturer shall provide instruction to the Owner's operating personnel. Training shall not be performed until the requirements of Paragraphs B, C, and D above have been fully satisfied and any specified performance testing completed. Training shall be provided for the number of days specified in each Equipment Section of these Specifications. Training shall be provided on an 8-hour-per-day basis. Partial days (less than 8 full working hours) shall not be credited toward the specified durations. Training shall not be concurrent with on-going testing, debugging, or installation activities but shall be a separate activity devoted exclusively to the instruction of the Owner's personnel in the operation and maintenance of the manufacturers' equipment. Training shall be performed by qualified representatives of each equipment manufacturer specifically skilled in providing instruction to operation personnel. Training shall provide an overview of operations and maintenance requirements and shall include but not be limited to the following:

1. Description of unit and component parts.
2. Operating capabilities and performance criteria.
3. Operating procedures.
4. Maintenance procedures.
5. Servicing and lubrication schedules.
6. Troubleshooting.

F. A certificate from the manufacturer stating that the installation of the equipment is satisfactory; that the unit has been satisfactorily tested and is ready for operation; and that the operating personnel have been suitably instructed in the operation, lubrication, and care of the unit shall be submitted before start-up and acceptance by the Owner. The certificate shall indicate date and time the instruction was given and names of the operating personnel in attendance.

G. See the detailed Specifications for additional requirements for furnishing the services of the manufacturers' field service technician.

H. For equipment furnished, the Contractor, unless otherwise specified, shall furnish the services of accredited field service technicians of the manufacturer only when some evident malfunction or over-heating makes such services necessary in the opinion of the Owner.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01650
DELIVERY, STORAGE, AND HANDLING

PART 1 GENERAL

1.01 SCOPE OF WORK

A. This Section specifies the general requirements for the delivery, handling, storage, and protection of all items required in the construction of the Work. Specific requirements, if any, are specified with the related item.

1.02 DELIVERY, STORAGE, AND HANDLING

A. The Contractor shall adhere to the requirements specified in this Section for storing and protecting the items.

B. The Contractor shall do the following:

1. Materials and equipment shall be loaded and unloaded by methods affording adequate protection against damage. Every precaution shall be taken to prevent injury to the material or equipment during transportation and handling. Suitable power equipment shall be used and the material or equipment shall be under control at all times. Under no condition shall the material or equipment be dropped, bumped, or dragged. When a crane is used, a suitable hook or lift sling shall be used. The crane shall be so placed that all lifting is done in a vertical plane. Materials or equipment skid loaded, palletized, or handled on skidways shall not be skidded or rolled against material or equipment already unloaded.

2. Material and equipment shall be delivered to the job site by means that will adequately support it and not subject it to undue stresses. Material and equipment damaged or injured in the process of transportation unloading or handling shall be rejected and immediately removed from the site.

3. The Contractor shall coordinate the delivery of all materials, including those furnished by the Owner. The Contractor shall be responsible for the proper transport, handling, and storing of all materials, and materials shall be protected to ensure their expected performance. Delivery schedules shall be coordinated by the Contractor, in advance, so that the Work will be done in a timely manner.

4. The Contractor shall coordinate deliveries of products with construction schedules to avoid conflict with work and conditions at the site. The Contractor shall also do the following:

    a. Deliver products in undamaged condition, in the manufacturer's original containers or packaging, with identifying labels intact and legible.
    b. Immediately on delivery, inspect shipments to ensure compliance with requirements of the Contract Documents and approved submittals and to ensure that the products are properly protected and undamaged.

5. The Contractor shall provide equipment and personnel to handle products by methods to prevent soiling or damage to products or packaging.

6. All materials and equipment shall be stored on-site in complete compliance with the manufacturer’s recommendations.

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

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

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

10. 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 that will prevent warping, twisting, bending, breaking, chipping, rusting, and any injury, theft, or damage of any kind to the material or equipment.

11. 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 removal.

12. The Contractor shall arrange storage in a manner to provide easy access for inspection and make periodic inspections of stored products to ensure that products are maintained under specified conditions, free from damage or deterioration.

13. The Contractor shall provide substantial coverings as necessary to protect installed products from traffic damage and subsequent construction operations and shall remove these coverings when they are no longer needed.

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

15. Schedule delivery to reduce long-term onsite storage before installation and/or operation. Under no circumstances shall equipment be delivered to the site more than 1 month before installation without written authorization from the Engineer.

16. Coordinate delivery with installation to ensure minimum holding time for items that are hazardous, flammable, easily damaged, or sensitive to deterioration.

17. Deliver products to the site in the manufacturer's original sealed containers or other packing systems, complete with instructions for handling, storing, unpacking, protecting, and installing.

18. Unload and place all items delivered to the site in a manner which will not hamper normal construction operation nor that of subcontractors and other contractors and will not interfere with the flow of necessary traffic.

19. Provide necessary equipment and personnel to unload all items delivered to the site.

20. The Contractor shall store and protect products in accordance with the manufacturer's instructions, with seals and labels intact and legible. Follow storage instructions, review them with the Engineer, and keep a written record of this. Arrange storage to permit access for inspection.

21. Store loose granular materials on solid flat surfaces in a well-drained area. Prevent mixing with foreign matter.

22. Store cement and lime under a roof and off the ground and keep it completely dry at all times. All structural, miscellaneous, 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 shall be handled and stored in a manner to prevent accumulations of dirt, standing water, staining, chipping, or cracking. Handle and store brick, block, and similar masonry products in a manner to keep breaking, cracking, and spilling to a minimum.

23. Store all mechanical and electrical equipment and instruments subject to corrosive damage by the atmosphere if stored outdoors (even though covered by canvas) in a weathertight building to prevent damage. The building may be a temporary structure on the site or elsewhere, but it must be satisfactory to the Engineer. The building shall be provided with adequate ventilation to prevent condensation. The Contractor shall ensure that temperature and humidity are maintained within the range required by the manufacturer.

    a. All equipment shall be stored fully lubricated with oil, grease, and other lubricants unless otherwise instructed by the manufacturer.
    b. Moving parts shall be rotated a minimum of once weekly to ensure 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 to ensure that the equipment does not deteriorate from lack of use.
    c. Lubricants shall be changed when installation is complete and as frequently as required thereafter during the period between installation and acceptance. The Contractor shall put new lubricants into the equipment at the time of acceptance.
    d. Before accepting equipment that has been stored for some time, 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.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01730
CUTTING, CORING, AND PATCHING

PART 1 GENERAL

1.01 SCOPE OF WORK

A. The Contractor shall provide all cutting, coring, fitting, and patching, including attendant excavation and backfill, required to complete the Work or to accomplish the following:

1. Make the Work's several parts fit together properly.
2. Uncover portions of the Work to provide for installation of ill-timed work.
3. Remove and replace defective work.
4. Remove and replace work not conforming to requirements of Subcontract Documents.
5. Remove samples of installed work as specified for testing.
6. Provide routine penetrations of non-structural surfaces for installing piping and electrical conduit.

1.02 SUBMITTALS

A. The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance.

B. The Contractor shall submit a written request well in advance of executing any cutting or alteration that affects the following:

1. Work of the Owner or any other Contractor.
2. Structural value or integrity of any element of the Project.
3. The integrity or effectiveness of weather-exposed or moisture-resistant elements or systems.
4. The efficiency, operational life, maintenance, or safety of operational elements.
5. Visual qualities of elements exposed to view.

C. The written request shall include the following:

1. Identification of the Project.
2. Description of affected Work.
3. The necessity for cutting, altering, or excavating.

4. The effect on the work of the Owner or any other Contractor or on the structural or weatherproof integrity of the Project.
5. Description of proposed Work:

    a. Scope of cutting, patching, alteration, or excavation.
    b. Trades which will execute the Work.
    c. Products proposed to be used.
    d. Extent of refinishing to be done.

6. Alternatives to cutting and patching.
7. Cost proposal, when applicable.
8. Written permission of any other Contractor whose work will be affected.

D. The Contractor shall submit written notice to the Engineer designating the date and the time the Work will be uncovered.

1.03 WARRANTIES

A. Warranties shall be in accordance with General Conditions, Supplementary Conditions, and Section 01780, Warranties and Bonds.

1.04 DELIVERY, STORAGE, AND HANDLING

A. The Contractor shall adhere to the requirements specified in Section 01650, Delivery, Storage, and Handling, for storing and protecting the items specified in this Section.

PART 2 PRODUCTS

2.01 MATERIALS

A. Concrete and grout for rough patching shall be in accordance with the Drawings and as specified in Division 3 Section 03600.

B. Materials for finish patching shall be equal to those of adjacent construction.

PART 3 EXECUTION

3.01 INSPECTION

A. The Contractor shall inspect existing conditions of project, including elements subject to damage or to movement during cutting and patching.

B. After uncovering Work, the Contractor shall inspect conditions affecting installation of products or performance of the Work.

C. The Contractor shall report unsatisfactory or questionable conditions to the Engineer in writing and shall not proceed with work until the Engineer has provided further instructions.

D. All cutting and coring shall be performed in such a manner as to limit the extent of patching.

E. All holes cut through concrete and masonry walls, slabs, or arches shall be core-drilled unless otherwise approved. No structural members shall be cut without approval of the Engineer, and all such cutting shall be done in a manner directed by the Engineer. No holes shall be drilled in beams or other structural members without obtaining prior approval. All work shall be performed by mechanics skilled in this type of work.

F. Rough patching shall be such as to bring the cut or cored areas flush with existing construction unless otherwise shown. Finish patching shall match existing surfaces as approved.

3.02 PREPARATION

A. Provide adequate temporary support as necessary to ensure the structural value or integrity of the affected portion of the Work.

B. Provide devices and methods to protect other portions of the Project from damage.

C. Provide protection from elements for that portion of the Project that may be exposed by cutting and patching work and maintain excavations free from water.

D. Perform coring with an approved non-impact rotary tools with diamond core drills. The size of the holes shall be suitable for pipe, conduit, sleeves, and equipment or mechanical seals to be installed.

E. Ensure that all equipment conforms to OSHA standards and specifications pertaining to plugs, noise and fume pollution, wiring, and maintenance.

F. Provide protection for existing equipment, utilities, and critical areas against water or other damage cause by drilling operation.

G. Following drilling, vacuum or otherwise remove from the area all slurry or tailings resulting from coring operations.

3.03 PERFORMANCE

A. Cut and demolish by methods that will prevent damage to other work and will provide proper surfaces to receive installation of repairs.

B. Excavate and backfill by methods which will prevent settlement or damage to other work.

C. Employ the original installer or fabricator to perform cutting and patching for the following:

1. Weather-exposed or moisture-resistant elements.
2. Sight-exposed finished surfaces.

D. Fit and adjust products to provide a finished installation to comply with specified products, functions, tolerances, and finishes.

E. Cut with a concrete wall saw and diamond saw blades of proper size.

F. Control slurry generated by sawing operation on both sides of wall.

G. When cutting a reinforced concrete wall, cut so as not to damage the bond between the concrete and reinforcing steel left in structure. Make the cut so that steel neither protrudes nor is recessed from the face of the cut.

H. Install adequate bracing of the area to be cut before cutting starts. Check the area during sawing operation for partial cracking and provide additional bracing as required to prevent a partial release of the cut area during sawing operations.

I. Provide equipment of adequate size to remove cut panel.

J. Restore work that has been cut or removed; install new products to provide completed work in accordance with requirements of Subcontract Documents.

K. Fit work airtight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.

L. Refinish entire surfaces as necessary to provide an even finish to match adjacent finishes:

1. For continuous surfaces, refinish to the nearest intersection.
2. For an assembly, refinish the entire unit.

M. Provide for Proper Pavement Restoration: The Contractor shall restore existing paving, including underdrains if any are encountered and broken into, and shall replace or rebuild the paving using the same type of construction as was in the original. The Contractor shall be responsible for restoring all such work, including subgrade and base courses where present. The Contractor shall obtain and bear the expense of such local or other governmental permits as may be necessary.

END OF SECTION

SECTION 01740
FINAL CLEANING

PART 1 GENERAL

1.01 SCOPE OF WORK

A. The Contractor shall execute cleaning during progress of the Work and at the completion of the Work as required by General Conditions.

1.02 WARRANTIES

A. Warranties shall be in accordance with General Conditions, Supplementary Conditions, and Section 01780, Warranties and Bonds.

1.03 DELIVERY, STORAGE, AND HANDLING

A. The Contractor shall adhere to the requirements specified in Section 01650, Delivery, Storage, and Handling, for storing and protecting the items specified in this Section.

1.04 ENVIRONMENTAL CONCERNS

A. Cleaning and disposal operations shall comply with codes, ordinances, regulations, and anti-pollution laws.

PART 2 PRODUCTS

2.01 CLEANING MATERIALS

The Contractor shall do the following:

A. Use only those cleaning materials which will not create hazards to health or property and which will not damage surfaces.

B. Use only those cleaning materials and methods recommended by the manufacturer of the surface material to be cleaned.

C. Use cleaning materials only on surfaces recommended by the cleaning material manufacturer.

PART 3 EXECUTION

3.01 PERIODIC CLEANING

The Contractor shall do the following:

A. Execute periodic cleaning to keep the work, the site, and adjacent properties free from accumulations of waste materials, rubbish, and windblown debris.

B. Provide on-site containers for the collection of waste materials, debris, and rubbish.

C. Remove waste materials, debris, and rubbish from the site periodically and dispose of at legal areas away from the site.

3.02 DUST CONTROL

The Contractor shall do the following:

A. Clean interior spaces before the start of finish painting and continue cleaning on an as-needed basis until painting is finished.

B. Schedule operations so that dust and other contaminants resulting from cleaning process will not fall on wet or newly coated surfaces.

3.03 FINAL CLEANING

The Contractor shall do the following:

A. Employ skilled workers for final cleaning.

B. Remove grease, mastic, adhesives, dust, dirt, stains, fingerprints, labels, and other foreign materials from interior and exterior surfaces exposed to view.

C. Broom clean exterior paved surfaces; rake clean other surfaces of the grounds.

D. Before final completion or Owner occupancy, inspect interior and exterior surfaces exposed to view and all work areas to verify that the entire Work is clean.

END OF SECTION

SECTION 01755
EQUIPMENT TESTING AND STARTUP

PART 1 GENERAL

1.01 SCOPE OF WORK

A. The Contractor shall provide a competent field services technician of the manufacturers of all equipment furnished under Divisions 11, Equipment, 15, Mechanical, and 16, Electrical, to supervise installation, adjustment, initial operation and testing, performance testing, final acceptance testing, and startup of the equipment.

B. The Contractor shall perform specified equipment field performance tests, final acceptance tests, and startup services.

1.02 SUBMITTALS

The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance:

A. Submit name, address, and résumé of proposed field services technicians at least 30 days in advance of the need for such services.

B. Submit for review detailed testing procedures for shop tests, field performance tests, and final acceptance tests as specified in the various Equipment Specification Sections. Test procedures shall be submitted at least 30 days in advance of the proposed test dates and shall include at least the following information:

1. Name of equipment to be tested, including reference to specification section number and title.
2. Testing schedule of proposed dates and times for testing.
3. Summary of power, lighting, chemical, water, sludge, gas, etc., needs and identification of who will provide them.
4. An outline of specific assignments of the responsibilities of the Contractor and manufacturers' factory representatives or field service personnel.
5. Detailed description of step-by-step testing requirements, with reference to appropriate standardized testing procedures and laboratory analyses by established technical organizations (e.g., ASTM, WPCF Standard Methods).
6. Samples of forms to be used to collect and record test data and to present tabulated test results.

C. Submit copies of test reports upon completion of specified shop, performance, and acceptance tests. Test reports shall incorporate the information provided in the test procedures submittals, modified to reflect the actual conducting of the tests and the following additional information:

1. Copies of all test data sheets and results of lab analyses.
2. Summary comparison of specified test and performance requirements vs. actual test results.
3. Should actual test results fail to meet specified test and performance requirements, a description of actions to be taken before re-testing the equipment.

D. Submit copies of the manufacturer's field service technician's report summarizing the results of the initial inspection, operation, adjustment, and pre-tests. The report shall include detailed descriptions and tabulations of the points inspected, tests and adjustments made, quantitative results obtained, suggestions for precautions to be taken to ensure proper maintenance, and the equipment supplier's Certificate of Installation in the format specified in this Section.

1.03 REFERENCE STANDARDS

Reference standards and recommended practices referred to in this Section shall be the latest revision of any such document in effect at the bid time. The following documents are a part of this Section. Where this Section differs from these documents, the requirements of this Section shall apply.

A. American Water Works Association (AWWA)

1. AWWA C653—Disinfection of Water Treatment Plants.

B. American Society for Testing and Materials (ASTM)

C. Water Pollution Control Federation (WPCF)

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

1.04 QUALITY ASSURANCE

A. Field service technicians shall be competent and experienced in the proper installation, adjustment, operation, testing, and startup of the equipment and systems being installed.

B. Manufacturers' sales and marketing personnel will not be accepted as field service technicians.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 PRELIMINARY REQUIREMENTS

A. After the equipment has been installed and the equipment is presumably ready for operation but before it is operated by others, the manufacturer's field service technician shall inspect, operate, test, and adjust the equipment. The inspection shall include at least the following points where applicable:

1. Soundness (without cracks or otherwise damaged parts).
2. Completeness in all details, as specified and required.
3. Correctness of setting, alignment, and relative arrangement of various parts.
4. Adequacy and correctness of packing, sealing, and lubricants.

B. The operation, testing, and adjustment shall be as required to prove that the equipment has been left in proper condition for satisfactory operation under the conditions specified.

C. Upon completion of this work, the manufacturer's field service technician shall submit a signed report of the results of his/her inspection, operation, adjustments, and tests.

3.02 WITNESS REQUIREMENTS

A. Shop tests or factory tests may be witnessed by the Owner and/or the Owner's representatives, as required by the various equipment specifications.

B. Field performance and acceptance tests shall be performed in the presence of the Owner, the Owner's designated personnel, and/or the Owner's representatives.

3.03 STARTUP AND ACCEPTANCE OF THE TREATMENT PLANT AND RELATED SYSTEMS

A. General Requirements

1. Successfully execute the step-by-step procedure of startup and performance demonstration specified in this Section.

2. The startup and performance demonstration shall be successfully executed before Substantial Completion and acceptance by the Owner of the treatment plant and its related systems.
3. All performance tests and inspections shall be scheduled at least 5 working days in advance or as otherwise specified with the Owner and the Engineer. All performance tests and inspections shall be conducted during Monday through Friday, unless otherwise specified.

B. Preparation for Startup

1. All mechanical and electrical equipment shall be checked to ensure that it is in good working order and properly connected. Preliminary run-ins of the various pumps, compressors, and other remaining equipment shall be made. All systems shall be cleaned and purged as required. All sumps, tanks, basins, chambers, pump wells, and pipelines which are hydraulically checked shall be drained and returned to their original condition once the water testing is complete.
2. All instruments and controls shall be calibrated through their full range. All other adjustments required for proper operation of all instrumentation and control equipment shall be made.
3. The Contractor shall perform all other tasks needed for preparing and conditioning the treatment facilities for proper operation.
4. No testing shall be conducted or equipment operated until the Engineer has verified that all specified safety equipment has been installed and is in good working order.
5. No testing shall be conducted or equipment operated until the Engineer has verified that all lubricants, tools, maintenance equipment, spare parts, and approved equipment operation and maintenance manuals have been furnished as specified.

C. Facilities Startup

1. The startup period shall not begin until all newly constructed facilities and equipment have been tested as specified and are ready for operation. The Owner shall receive spare parts, safety equipment, tools and maintenance equipment, lubricants, approved operation and maintenance data, and the specified operation and maintenance instruction before the startup with waste water. All valves shall be tagged before this startup.

2. Demonstrate 7 consecutive 24-hour days of successful operation of the facility as a prerequisite of Substantial Completion and Acceptance.

3. If the facility fails to demonstrate satisfactory performance on the first or any subsequent attempt, the Contractor shall make all necessary

alterations, adjustments, repairs, and replacements. When the facility is again ready for operation, it shall be brought on line and a new test shall be started. This procedure shall be repeated as often as necessary until the facility has operated continuously to the satisfaction of the Owner and Engineer for the specified duration.

4. The Owner will furnish all operating personnel (other than vendor's or subcontractor's service personnel) needed to operate equipment during the final test period; however, these personnel will perform their duties under the Contractor's direct supervision. Until performance tests are completed and units and systems are accepted by the Owner as substantially complete, the Contractor shall be fully responsible for the operation and maintenance of all new facilities.

5. The Owner will provide all necessary water and electricity. However, the Contractor shall provide all necessary personnel of the various construction trades, i.e., electricians, plumbers, etc., and field service personnel of the major equipment suppliers on an 8-hour-per-day basis at the facilities and on a 24-hour-per-day basis locally during the startup period. Major equipment suppliers shall include but not be limited to the following:

    a. Telemetry, Instrumentation, and Control Equipment.
    b. Treatment Units.
    c. All Pumping Equipment.

6. At no time during startup shall the Contractor allow the facility to be operated in a manner that subjects equipment to conditions that are more severe than the maximum allowable operating conditions for which the equipment was designed.

END OF SECTION

SECTION 01770
PROJECT CLOSEOUT

PART 1 GENERAL

1.01 SUBSTANTIAL COMPLETION

A. When the Contractor considers that the Work or designated portion of the Work is Substantially Complete, the Contractor shall submit written notice to the Engineer with a list of items to be completed or corrected.

B. If the Engineer's review finds that the Work is not substantially complete, the Engineer will promptly notify the Contractor in writing, listing observed deficiencies.

C. The Contractor shall remedy deficiencies and send a second written notice of Substantial Completion.

D. When the Engineer finds the Work is Substantially Complete, the Engineer will prepare a Certificate of Substantial Completion.

1.02 FINAL COMPLETION

A. When the Contractor considers that the Work or designated period of the Work is complete, the Contractor shall submit written certification to the Engineer indicating the following:

1. The Contract Documents have been reviewed.
2. The Work has been reviewed for compliance with the Contract Documents.
3. The Work has been completed in accordance with the Contract Documents and deficiencies listed with Certificates of Substantial Completion have been corrected.
4. The Work is complete and ready for final inspection.
5. All required shop drawings, catalog cuts, operations and maintenance manuals, instruction manuals, test reports, samples, and all other submittals have been submitted and reviewed by the Engineer.
6. All deliverables have been delivered or placed as accepted by the Engineer.

B. If the Engineer's inspection reveals that the Work is incomplete, the Engineer will promptly notify the Contractor in writing listing observed deficiencies.

C. The Contractor shall remedy deficiencies and send a second certification of Final Completion.

D. When the Engineer finds that the Work is complete, the Engineer will consider closeout submittals.

1.03 ADDITIONAL REVIEW FEES

A. If the status of Completion of Work requires more than two reviews of the Work by the Engineer due to failure of the Work to comply with the Contractor's claims on the first and second reviews, the Owner will deduct from the final payment to the Contractor the amount of the Engineer’s compensation for additional review services.

1.04 CLOSEOUT SUBMITTALS

A. Evidence of Compliance with Requirements of Governing Authorities:

1. Certificate of Occupancy.
2. All required Certificates of Government Inspections.

B. Operation and Maintenance Manuals: Under provisions of Section 01830, Operations and Maintenance Manuals.

C. Evidence of Payment and Release of Liens: In accordance with Conditions of the Contract.

D. Consent of Surety to Final Payment.

1.05 STATEMENT OF ADJUSTMENT OF ACCOUNTS

A. Submit final statement reflecting adjustments to total Contract Price, indicating the following:

1. Original total Contract Price.
2. Previous change orders.
3. Changes under allowances.
4. Changes under unit prices.
5. Deductions for uncorrected Work.
6. Penalties and bonuses.
7. Deductions for liquidated damages.
8. Deductions for Engineer’s additional review fees.
9. Other adjustments to total Contract Price.
10. Total Contract Price as adjusted.

11. Previous payments.
12. Sum remaining due.

B. Upon the Owner's review and approval, the Engineer will issue a final Change Order reflecting approved adjustments to the total Contract Price not previously made by change orders.

1.06 APPLICATION FOR FINAL PAYMENT

A. Submit application for final payment in accordance with provisions of Conditions of the Contract.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01780
WARRANTIES AND BONDS

PART 1 GENERAL

1.01 SCOPE OF WORK

The Contractor shall do the following:

A. Compile specified warranties and bonds.
B. Co-execute submittals when so specified.
C. Review submittals to verify compliance with Contract Documents.
D. Submit submittals to the Owner for review.

1.02 SUBMITTALS

The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance:

A. Assemble warranties, bonds, and service and maintenance contracts executed by each of the respective manufacturers, suppliers, and subcontractors.

B. Number of original signed copies required: Two each.

C. Table of Contents: Neatly typed, in sequence of the Specifications. Provide completion information for each item as follows:

1. Product or work item.

2. Firm, address, telephone and fax numbers, and name and email of principal.

3. Scope.

4. Date of beginning of warranty, bond, or service and maintenance contract.

5. Duration of warranty, bond, or service and maintenance contract.

6. Provide information for Owner's personnel:

a. Proper procedure in case of failure.
b. Instances that might affect the validity of warranty or bond.

7. Contractor, with address, telephone and fax numbers, and the name and email of responsible principal.

D. Submittal of warranties, bonds, and service and maintenance contracts shall be included in submittals for review and before Final Completion with actual dates included.

E. The Contractor's obligation to correct defective or nonconforming Work shall run for 1 year (or such longer period may otherwise be specified in the Contract Documents) beginning from the date Substantial Completion is achieved.

1.03 WARRANTIES

A. Warranties shall be in accordance with General Conditions, Supplementary Conditions, and this Section.

B. All mechanical and electrical equipment together with devices of whatever nature and all components which are furnished and/or installed by the Contractor shall be guaranteed.

C. The guarantee shall be against the manufacturing and/or design inadequacies, materials, and workmanship not in conformity, improper assembly, hidden damage, failure of devices and/or components, excessive leakage, or other circumstances which would cause the equipment to fail under normal design and/or specific operating conditions for 1 year or such longer period as may be shown and/or specified from and after the date of Substantial Completion.

D. The Contractor shall replace and install each piece of equipment, device, or component which shall fail within the term specified above of the guarantee with reasonable promptness without increase in the Contract Price. If the Contractor fails to provide timely repairs as specified in this Section, the Owner shall issue a claim against the Contractor's Bond. In some instances, if approved by the Owner, the Contractor may be allowed to repair the equipment.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01815
MAINTENANCE OF PLANT OPERATION AND SEQUENCE OF CONSTRUCTION

PART 1 GENERAL

1.01 SCOPE OF WORK

A. The existing water reclamation facility will be maintained in continuous operation by the Owner at all times during the entire construction period. The Contractor shall schedule and conduct his work such that it will not impede any treatment process, create potential hazards to operating equipment and/or personnel, reduce the quality of the plant effluent, result in any spills or leakage, or cause odor or other nuisance.

B. The Contractor shall schedule his operations to conform to the requirements specified herein and shall include in his construction schedule all events which will impact operation of the existing treatment facilities.

C. The Owner will continue to operate the treatment facilities during the construction period and will be responsible for maintaining effluent quality. The Contractor shall fully cooperate with the Owner, coordinate the construction schedule with the Owner and Engineer, and provide the necessary labor, equipment, and materials to prevent interruption to flow and treatment. The Owner and Engineer reserve the right to modify or expand the schedule during construction to meet prevailing conditions.

D. The Contractor shall not make any alterations to affect operation of the treatment facility without giving two weeks prior written notice to the Owner and Engineer requesting authorization to proceed. Except as noted herein, the Owner will perform all operation of existing valves or equipment.

E. Operation of valves or equipment by the Owner may be limited on specific occasions because of process limitations or unavailability of personnel. Delays caused by such limitations shall be expected and shall not be the basis for claim of extra costs by the Contractor.

F. The work specified in this Section shall be accomplished at such times that will be convenient to the Owner as specified in Section 01100, Summary of Work. Night work or overtime work by the Contractor to conform to these requirements shall be considered as normal procedure under this Contract, and the Contractor shall make no claim for extra compensation as a result of this night work or overtime work.

G. To maintain continuous treatment facilities operation during construction a phased removal and construction sequence shall be required. Specific constraints are outlined in this Section. The Contractor shall submit to the Engineer a detailed sequence of construction to complete the work while maintaining plant operation.

H. The Contractor shall furnish all temporary materials and equipment, such as flow diversion, bypass pumping, coffer dam, temporary power, etc., that may be required to complete the work of this Contract.

1.02 SUBMITTALS

The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance:

A. Submit a complete description of procedures to maintain plant operation to supplement the construction schedule developed. The description shall include step-by-step procedures, required duration, and specific procedures required to be performed by the Owner's personnel.

B. Submit complete plans of temporary systems required as part of this contract to maintain plant operations. The plans shall clearly delineate the intended location of these items and the Contractor's proposed method for phasing from existing to temporary to completed facilities.

1.03 MAINTAIN OPERATIONS

A. The existing treatment facilities shall be maintained in operation during construction of the proposed improvements. The degree of treatment during construction shall be equal to or exceed the degree of treatment required for effluent limits listed in the Florida Department of Environmental Protection (FDEP) Wastewater Facilities Construction Permit. Bypassing unit treatment operations or reduced levels of treatment shall not be permitted.

B. The Contractor shall be fully responsible for providing all temporary pumping, piping and yard piping, fuels, lubricants, chemicals, plumbing, power, heating, ventilating, air-conditioning, lighting, temporary structures, or whatever may be required to maintain wastewater treatment operations at no additional cost to the Owner. All details of temporary piping and temporary construction are not shown in the Drawings or covered in the Specifications. However, this does not relieve the Contractor of the responsibility to maintain provisions for the Owner to provide wastewater treatment.

1.04 COORDINATION

A. The Contractor shall fully cooperate in coordinating their activities to provide the least interference with the Owner's operations and other contractors and utility companies working in the area and in the interfacing and connecting of the separate elements of the overall project work.

B. If any difficulty or dispute should arise in the coordination of activities, the Contractor shall immediately bring the problem to the Engineer's attention.

C. All contractors and subcontractors working on this site are subject to this requirement for cooperation, and all shall abide by the Engineer's decision in resolving project coordination problems without additional cost to the Owner.

D. FDEP and/or the Owner may require modifications or alterations to the Contractor's sequence of construction. The Contractor shall cooperate with the Owner and regulatory agencies to the maximum extent possible.

E. Certain parts of the construction work may need to be done outside normal working hours to avoid undesirable conditions. The Contractor shall provide notification to the Owner in advance in accordance with Section 01100, Summary of Work. The Contractor shall do this work at such times and at no additional cost to the Owner. Do not make connections between existing work and new work until necessary inspections, reviews, and tests, as required, have been completed on the new work and approved by the Engineer in accordance with the requirements of the Contract Documents.

F. Piping and equipment removals and modifications or electrical tie-ins requiring shutdown of flow to the plant, process bypass, or flow diversion shall be coordinated with and pre-approved by the Owner in writing at least 14 calendar days in advance.

G. All piping and conduit shown to cross existing roads in the same area shall be laid at one time so that disruption to plant access is minimized.

H. Interconnecting piping, utilities, and structures that are required to incorporate existing treatment systems, structures, or facilities with new treatment systems, structures, or facilities shall be performed at one time so that disruption to wastewater treatment operations is minimized.

1.05 CONSTRUCTION SEQUENCE OUTLINE

A. To meet the overall objectives of the project, certain elements of the work must be completed or substantially completed in certain sequences. The Contractor is

responsible and shall take any and all steps necessary to maintain continuous operation of the Owner's existing facilities. The Contractor shall develop and submit for approval by the Engineer and Owner a written construction sequence plan and schedule to minimize construction impacts on treatment plant operations and wastewater treatment efficiency. Certain stages shall be required to be completed before subsequent stages can be initiated.

B. To maintain wastewater treatment plant operation, the Contractor's construction sequence shall be subject to the constraints described in Article 1.06 of this Section.

1.06 CONSTRUCTION SEQUENCE OVERVIEW

A. The constraints described herein are to maintain the operation of the treatment facility and to minimize interruption. The existing facilities are to be modified, altered, or expanded and shall incorporate the proposed new facilities. Treatment shall be maintained, and effluent limitations and sampling requirements shall be complied with throughout the construction work. Refer to the Contract Drawings for existing and new facilities names, locations, acronyms, and abbreviations.

B. Various components may be completed concurrently to minimize downtime.

1.07 PROGRESS OF THE WORK

A. The work shall be started within the period stated in the Notice to Proceed, and the work shall be executed to prevent any delay to the general completion of the project.

B. The work shall be executed at such times and in or on such parts of the project and with such forces, materials, and equipment to ensure completion of the work in the time established by the Contract.

C. If the Contractor for their convenience and at their own expense desires to work outside the regular hours described in Section 01100, Summary of Work, the Contractor shall submit written notice to the Engineer and allow ample time for satisfactory arrangements to be made for the Owner and Engineer to observe the work in progress. The Contractor shall pay the expenses for extra work observation required of the Engineer for work outside regular work hours. The Contractor shall provide sufficient work lighting and any other necessary safety precautions for the different parts of the project as required to comply with all applicable federal and state regulations and with the approval of the Owner.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 GENERAL

A. The following constraints shall be applied to all equipment, treatment units, and appurtenances and utility systems on the plant site.

1. Vehicular access for the Owner's personnel to the plant site and to all operating treatment units shall be maintained at all times.
2. Plant operating personnel shall have access to all areas that remain in operation.
3. Potable water supply to the plant shall remain operational at all times.
4. Sanitary facilities shall remain operational at all times.
5. Electric power and lighting service shall be uninterrupted.
6. If underground piping or utilities not shown on the Drawings are encountered, such piping or utilities shall not be disturbed without prior approval of the Engineer and Owner.
7. Before making a change in existing piping, electrical, or control systems, the Contractor shall inform the Owner and Engineer of such change and assist in instructing operations and maintenance personnel in any new operating procedures.
8. Portions of some pipelines must remain in service while alterations are being made on other portions. Piping systems that must remain in service shall be isolated by placing blind flanges, plugs, or caps on all open ends.
9. Flow to and through the treatment plant shall not be interrupted.
10. Before shutting down a piece of equipment to allow for rebuilding or re-piping, the Contractor shall have on hand all materials required to reconstruct the piping system in its new arrangement.
11. All temporary facilities provided by the Contractor must be demonstrated to be operational to the satisfaction of the Engineer before any existing systems can be removed from use. The temporary facilities are critical to the operation of the wastewater treatment facilities. Availability of these facilities must be maintained at all times. The Contractor must respond to requests from the Engineer and Owner for repair and maintenance immediately (7 days per week, 24 hours per day, including holidays). If the Contractor fails to immediately respond to requests for repair and maintenance, such repair and maintenance may be performed by the Owner. All costs associated with such repair and maintenance performed by the Owner shall be the responsibility of the Contractor.

3.02 SEQUENCE OF CONSTRUCTION

The following and as specified elsewhere are the minimum requirements and suggested sequence of construction for the Contractor's use in developing a sequence of construction and

maintenance of plant operation plan that shall be submitted to the Engineer and Owner for review:

A. The Contractor shall have an adequately sized and designed bypass pumping system in place and fully functional with demonstration to the Owner and Engineer before beginning work on the other items.

B. The Contractor may install a bypass system to fully bypass the existing screw pumps process to perform the work or implement a phased approach, if approved by the Owner under the Deductive Bid Alternate, with a smaller bypass pumping system installed and perform replacement, start-up, and testing and other related work, one screw pump at a time to maintain the required Class 1 Reliability.

C. If the Contractor chooses to replace one screw pump at a time with a bypass system meeting the reliability requirements, and if approved by the Owner under the Deductive Bid Alternate, the Contractor shall demolish the existing screw pumps and other items and install, test, and place into service new screw pumps and appurtenances in a sequence that is reviewed by the Engineer and Owner.

D. Bypass pump system shall remain in place during start-up and testing of the new screw pumps and until the new screw pumps operations are successfully demonstrated to the Engineer and Owner.

E. Bypass Pumping System (Refer to Drawing Sheet M4 for Additional Notes)

1. The Contractor shall be responsible for maintaining and operating all temporary systems during construction. The Contractor is responsible for any spills of screw pump contents. Spills of any nature caused by the Contractor shall be controlled and cleaned immediately. Any spills onsite must be recorded with volume and actions taken to clean area and reported to the Owner and Engineer, who shall coordinate with FDEP.

2. The Contractor shall verify the flow range with the Engineer and Owner before designing the bypass system. The work shall be completed to minimize bypass time. The Contractor shall submit a bypass plan to the Owner and Engineer for review and approval. The bypass system shall be capable of pumping the plant's current flows as follows:

    a. Minimum Day – 10.5 MGD.
    b. Average Day – 12.0 MGD.
    c. Peak Hour – 17.2 MGD.

3. The Contractor shall coordinate with the Engineer and Owner before taking any channels, pumps, gates, pipes, or other equipment out of service. All temporary systems shall be installed and operational, all flow diversion valves shall be checked and operable, and the flow channels shall be cleaned.

4. Installing cofferdams is expected to isolate the screw pump lift station to fully bypass the screw pumps. After the screw pumps have been isolated, the Contractor shall pump down and clean the isolated area. While the screw pumps are isolated for replacement, all work within each area shall be completed.

5. The Contractor shall refurbish the existing slide gates one at a time. After the area has been isolated, the Contractor shall pump down and clean the isolated area and then refurbish the slide gate.

6. The bypass pump system shall remain in place during start-up and testing of the new screw pumps and until the new screw pumps operation is successfully demonstrated to the Engineer and Owner.

END OF SECTION

SECTION 01820
TRAINING

PART 1 GENERAL

1.01 SCOPE OF WORK

The Contractor shall do the following:

A. Instruct and train the Owner's personnel in the operation and maintenance of the equipment and systems supplied and/or installed under this Contract.

B. Incorporate operation and maintenance data and training services furnished by the suppliers into the training program such as shop drawings, equipment manuals, and start-up engineering and training assistance.

C. Ensure that system suppliers provide a qualified training instructor to help the Contractor train the Owner's employees in the proper operation and maintenance of all equipment and systems.

D. Prepare instructors and training materials required for complete factory, field, classroom, and hands-on training.

E. Furnish training videos and manuals during the training program.

F. Include in the total Contract Price the cost for training equipment; preparing training manuals; conducting classroom instructions; performing field, factory, and hands-on training; and coordinating and incorporating training service provided by suppliers and all other activities required to provide a comprehensive training program of sufficient length, as determined by the Owner.

1.02 WORK SEQUENCE

A. All factory training programs, if required, shall be completed before start-up of the Owner's system and shall use equipment similar to the Owner's equipment.

B. The field training programs shall be conducted in accordance with the approved schedule.

C. Individuals requiring training shall be trained in small groups during Mondays through Fridays. The Contractor will normally provide training during the 8-hour dayshift.

D. The hands-on training shall be conducted with a maximum of 10 students per instructor.

E. The Contractor shall coordinate and submit a training schedule to the Engineer 30 days before the first training event.

1.03 QUALITY ASSURANCE

A. Preparation of training materials and instructions to be provided shall be performed by personnel:

1. Trained and experienced in operation and maintenance of equipment and systems installed under this Contract.
2. Familiar with the training requirements of the Owner.

B. The Contractor shall furnish résumés, including three outside references, for each instructor to be used in the training program.

C. The Engineer and Owner may review the résumés. Based on the review of the résumés and contacts with references, the Engineer shall approve, request additional information, or reject proposed instructors for the training program. If a proposed instructor is rejected, the Contractor shall submit the résumé and references of another candidate within a reasonable time.

1.04 TRAINING PLAN

A. At the completion of the Work, the Contractor shall provide a competent and experienced person thoroughly familiar with the Work for not less than 3 days to instruct permanent operating personnel in the operation of equipment and control systems.

B. At least 30 days before training, the Contractor shall submit to the Engineer a detailed training plan including the following:

1. Title and objectives.
2. Training schedule.
3. Prerequisite training and experience of attendees.
4. Recommended types of attendees (e.g., managers, engineers, operators, maintenance staff).
5. Course description and outline of course content.
6. Duration.
7. Location (e.g., training center or site).
8. Format (e.g., lecture, self-study, demonstration, hands-on).
9. Instruction materials and equipment requirements.

1.05 FORM OF TRAINING MANUALS

A. The Contractor shall prepare training packages in the form of an instruction manual for use by the Owner's personnel. At least 30 days before the training, the Contractor shall submit the training packages to the Engineer for acceptance.

B. Format

1. Size: 8 1/2 x 11 inches (21.59 x 27.94 cm).

2. Paper: 20-pound (9.072 kg) minimum, white, for typed pages.

3. Text: Manufacturer's printed data or neatly word processed including the following:

   a. Table of contents.
   b. Pretest.
   c. Learning objectives.
   d. General operations, theory, and specific equipment information.

4. Drawings

   a. Provide reinforced punched binder tab, bind in with text.
   b. Reduce larger drawings and fold to size of text pages, not larger than 11 x 17 inch (27.94 x 43.18 cm).

5. Cover: Identify each volume with the following:

   a. Title of Project.
   b. Identity of separate structure or system as applicable.
   c. Identity of general subject matter covered in the manual.
   d. Locations.

C. Binders

1. Commercial quality three-post binders with durable and cleanable plastic covers.
2. Maximum post width shall be 3 inches (7.62 cm).
3. When multiple binders are used, correlate the information into related consistent groupings.

1.06 VIDEOTAPED TRAINING MATERIAL

The Contractor shall do the following:

A. Produce or provide video training material subject to approval of the Owner.

B. Furnish digital copies of each video recording. The Owner may request this in DVD format in a plastic case with title, the Owner's name, and time on a label in a clear plastic sleeve, at no additional cost.

C. Bear all costs associated with production and provision of the DVDs, if DVDs are requested by the Owner.

1.07 INSTRUCTIONS

A. At the completion of Work, the Contractor shall provide a competent and experienced person thoroughly familiar with the Work for a period of time as directed by the Owner to instruct permanent operating personnel in the operation of equipment and control systems.

B. The Contractor shall furnish four complete sets of operating instructions applying to each piece of equipment installed in conjunction with this Contract.

C. An "As-Installed" diagram of all control wiring and operating instructions shall be mounted in a watertight pocket on the inside door of the control panel of each unit.

D. Unless otherwise specified, the Contractor shall provide engraved metal, plastic tags, or instructions on any valve, switch, control, pipe or other piece of equipment which is not self-evident as to its function or mode of operation. This includes, but is not limited to, all exposed piping and all switches. This shall particularly apply to operations that must be manually sequenced.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01830
OPERATIONS AND MAINTENANCE MANUALS

PART 1 GENERAL

1.01 SCOPE OF WORK

The Contractor shall do the following:

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

1. Prepare operating and maintenance data as specified in this Section and as referenced in other pertinent sections of the Specifications. The data presented in the O&M Manuals shall be specifically related to this Contract and application.
2. Incorporate operation and maintenance data furnished by the Owner, if any.

B. Furnish all labor, equipment, materials, and all other items to supply and deliver to the Owner two hardcopy and an electronic copy of O&M Manuals for the Work in accordance with the requirements of this Section.

C. Provide two hardcopy and an electronic copy of O&M Manuals for all equipment, including instrumentation, electrical, and process control system equipment and software for the entire Facility.

1.02 SUBMITTALS

The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance:

A. Manuals which, in general, shall have two levels: a facilities-wide systems level and an individual-component level.

1. The facilities-wide systems level shall do the following:

a. Describe the facilities-wide systems, including diagrams.
b. Explain start-up, shutdown, normal operations, and malfunctions of the facilities-wide systems.
c. Tabulate a lubrication schedule for the facilities-wide systems.

d. Describe preventive maintenance checking procedures for the facilities-wide systems.
e. Include a cross-reference to all individual component manuals.

2. The individual-component level shall contain the following:

a. Storage requirements.
b. Installation instructions.
c. Alignment instructions and tolerances.
d. Operating instructions.
e. Troubleshooting instructions.
f. Lubrication requirements.
g. Maintenance instructions.
h. Parts list.
i. Recommended spare parts list and how to obtain same.

B. Format

1. Size: 8 1/2-x-11-inch format for narrative and figures. Larger standard sizes are acceptable for drawings.

2. Text: Manufacturer's printed data or neatly word-processed.

3. Provide a new page for each separate product or each piece of operation equipment.

a. Provide a word-processed description of the product and major component parts of equipment.
b. Provide indexed tabs.

4. Cover: Identify each volume with the typed title, "OPERATION AND MAINTENANCE INSTRUCTIONS," listing the following:

a. Title of Project.
b. Identity of separate structure as applicable.
c. Identity of general subject matter covered in the manual.

5. All word processing must be done using the latest version of Microsoft Word or a version specified by the Owner.

6. Arrange the data into related consistent groupings and cover all with a table of contents and index with page numbering of all sheets.

C. The Contractor shall submit the following:

1. Equipment Manuals—O&M Instruction Manual for each piece of equipment shall be submitted to the Owner with delivery of the equipment.
2. Systems O&M Manuals—Systems O&M Manuals, indexed and submitted to the Owner no later than 14 days before the Facility's start-up. Systems O&M Manuals will be complete except for field results and refinements added as result of demonstrations.
3. Final O&M Manuals—Final Equipment and Systems O&M Manuals, indexed and submitted to the Owner before the Substantial Completion under this Contract.
4. The cost of these Manuals shall be included in the total Contract Price.

D. Any modifications required after final O&M submission shall be made to the manuals by issuance of complete replacement O&M manuals. Addenda with pages for insertion into manuals previously provided are not allowed. The updated manuals shall be accompanied by a written description of the changes made to the manual.

1.03 REFERENCE STANDARDS

Reference standards and recommended practices referred to herein shall be the latest revision of any such document in effect at the bid time. The following documents are a part of this Section. Where this Section differs from these documents, the requirements of this Section shall apply.

A. Florida Administrative Code (FAC)

1. Rule 62-600.410 FAC—Operation and Maintenance Requirements – Domestic Wastewater Facilities.

1.04 QUALITY ASSURANCE

A. Data shall be prepared by personnel:

1. Trained and experienced in maintaining and operating the described products.
2. Familiar with requirements of this Section.
3. Skilled as a technical writer to the extent required to communicate essential data.
4. Skilled as a person competent to prepare required drawings.

1.05 CONTENTS, EACH VOLUME

A. Neatly word-processed table of contents for each volume, arranged in systematic order, to include the following:

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

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

3. A list with each product, name, address, fax number, and telephone number of the following:

   a. Subcontractor or installer.
   b. A list of each product to be included, indexed to content of the volume.
   c. Identify area of responsibility of each subcontractor or installer, if more than one.
   d. Local source of supply for parts and replacement.
   e. Manufacturer.

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

B. Product Data

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

2. Annotate each sheet to achieve the following:

   a. Clearly identify the specific product or part installed.
   b. Clearly identify data applicable information.
   c. Delete references to inapplicable information.

C. Drawings

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

   a. Relations of component parts of equipment and systems.
   b. Control and flow diagrams.
   c. Owner Tag Numbers.

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

3. Do not use Record Documents as maintenance drawings.

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

1. Organize in consistent format under separate headings for different procedures.
2. Provide a logical sequence of instructions for each procedure.
3. Describe how the complete system is to operate.

E. Copy of pertinent information related to warranty, bond, and service Contract issued.

1. Provide information sheet for Owner's personnel with the following information:

a. Proper procedures in event of failure.
b. Instances that might affect the validity of warranties or bonds.

F. Training manuals used in training courses will become part of this Manual.

1.06 MANUAL FOR MATERIALS AND FINISHES

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

1. Manufacturer’s data, giving full information on products:

a. Catalog number, size, composition.
b. Color and texture designations.
c. Information required for re-ordering special-manufactured 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 that are detrimental to product.
c. Recommended schedule for cleaning and maintenance.

B. Content, for moisture-protected 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.

C. Additional requirements for maintenance data as required by other sections of the Specifications.

1.07 MANUAL FOR EQUIPMENT AND SYSTEMS

A. Content, for each electrical, mechanical, instrumentation, and communication system, as appropriate:

1. A table identifying each piece of equipment, each associated control or instrument, the location of the control or instrument, and the function of the control or instrument.

2. A description of the system and its component parts:

a. Function, normal operating characteristics, and limiting conditions for the system, the sub-system, and the component parts.
b. Performance curves, engineering data, and tests.
c. Complete nomenclature and commercial numbers of replaceable parts.

3. Circuit directories of panel board:

a. Electrical service.
b. Controls.
c. Communications.

4. As-installed color-coded wiring diagrams.

5. Instrument loop diagrams showing the path that a control or instrumentation signal takes from its origin to the action it takes.

a. An electrical schematic for each item.
b. A chart listing the controls/instruments in a loop identifying the equipment's abbreviated symbol, a description of the symbol,

design criteria, process flow, quantity supplied, and manufacturer's model and serial number.

6. Operating procedures:

    a. Routine and normal operating instructions.
    b. Sequences required.
    c. Special operating instructions.

7. Maintenance procedures:

    a. Routine operations.
    b. Guide to "troubleshooting."
    c. Disassembly, repair, and re-assembly.
    d. Alignment, adjustment, and checking.

8. The manufacturer's operating and maintenance instructions.

9. A list of the original manufacturer's spare parts, manufacturer's current prices, and recommended quantities to be maintained in storage.

10. Other data as required under other sections of the Specifications.

11. Abnormal and emergency operations:

    a. Potential overloads.
    b. Procedures for equipment breakdown.
    c. Action to be taken in a power outage.
    d. Identity of alarms by equipment location and action to correct.
    e. Equipment safety features, requirements, and potential hazards.

12. Programming manuals for programmable devices including list of standard programming.

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. Model number and name plate data for each piece of equipment.

e. Assembly drawings.
f. List of all special tools required to service equipment and/or systems including where the tools are stored.

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.
e. Control settings and ranges.

3. Maintenance procedures:

a. Type and frequency of preventive maintenance activities required for each piece of equipment.
b. Guide to "troubleshooting."
c. Disassembly, repair, and re-assembly.
d. Alignment, adjusting, and checking.

4. Servicing and lubrication schedule:

a. List of lubricants required.

5. Period between lubrications.

6. Manufacturer's printed operating and maintenance instructions. (This is not to be a generalized catalog of the entire product line.)

7. Description of sequence of operation.

8. The 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.

9. As-installed control diagrams.

10. Each Contractor's coordination drawings.

11. List of the 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 the Specifications.

13. Charts of equipment, instrument, and valve tag numbers with location and function:

    a. Reference drawing which shows equipment, instrument, or valve location.
    b. Manufacturer's model and serial number.
    c. Valve actuator type (manual, hydraulic, electric, or pneumatic).

14. Local services (process water and air, drains, HVAC, natural gas and steam).

C. The Contractor shall prepare and include additional data when the need for such data becomes apparent during instruction of the Owner's personnel.

D. Additional requirements for O&M data required by other sections of the Specifications.

PART 2 PRODUCTS

2.01 O&M MANUALS

A. Printed in Binders: The manuals shall be printed and supplied in binders that are as follows:

1. Three ring binders with hard covers.
2. Filled to not more than 75% capacity.
3. When multiple binders are used, arrange the data into volumes containing related equipment, products and systems.
4. Label each binder volume with a volume number, total number of volumes (e.g., 1 of 3), and descriptive volume title.
5. Confirm binder arrangement and layout with Owner if clarification or guidance is needed.

PART 3 EXECUTION (NOT USED)

END OF SECTION

DIVISION 2

SITE CONSTRUCTION

SECTION 02220
DEMOLITION AND MODIFICATIONS

PART 1 GENERAL

1.01 SCOPE OF WORK

A. The Contractor shall furnish all labor, materials, equipment, and incidentals required and demolish, modify, remove, and dispose of work shown on the Drawings and as specified in this Section.

B. The work includes but is not limited to demolishing, modifying, and removing existing materials, equipment, or work necessary to install the new work as shown on the Drawings and as specified in this Section and to connect with existing work in an approved manner.

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

D. Demolition and modifications include:

1. Removal and disposal of existing screw pumps and motors, electrical equipment, and miscellaneous items as shown on the Drawings.
2. Off-site disposal of excess and unacceptable materials.

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

1.02 SUBMITTALS

The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance:

A. Submit to the Engineer six copies of proposed methods and operations of demolition of the structures and modifications before beginning 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. The sequence shall be compatible with sequence of construction and shutdown coordination requirements.

C. Before beginning demolition work, the Contractor shall complete all modifications necessary to bypass the affected structure. Actual work shall not begin until the Engineer has observed and approved the modifications and authorized beginning the demolition work in writing.

1.03 QUALITY ASSURANCE

A. The Contractor shall engage the service of a professional engineer registered in the State of Florida for the design of the temporary shoring/bracing of the existing structure and hung utilities during the demolition, repair, and replacement of the Screw Pumps, etc.

1.04 JOB CONDITIONS

A. Protection

1. The Contractor shall conduct the demolition and removal work to prevent damage or injury to structures, equipment, piping, instrumentation, conduit, light fixtures, etc., and occupants of the structures and to adjacent features that might result from falling debris or other causes, and not interfere with the use and free and safe passage to and from adjacent structures.

B. Scheduling

1. The Contractor shall carry out operations to avoid interference with operations and work in the existing facilities.

C. Notification

1. At least 48 hours before beginning demolition or removal, the Contractor shall notify the Engineer in writing of the proposed schedule of the demolition or removal. The Owner shall inspect the existing equipment and identify and mark those items that are to remain on 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 before the start of demolition work.

E. Repairs to Damage

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

F. Traffic Access

1. The Contractor shall conduct demolition and modification operations and remove equipment and debris to ensure minimum interference with roads onsite 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.

1.05 RULES AND REGULATIONS

A. The Florida Building Code or the City shall control the demolition, modification or alteration of the existing buildings or structures.

B. No building or structure or any part thereof shall be demolished until an application has been filed with the Building Inspector and a permit issued. The fee for this permit shall be the Contractor's responsibility.

1.06 DISPOSAL OF MATERIAL

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

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

C. Storing or selling 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 and shall be 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. The Contractor shall dispose of all demolition materials, equipment, debris, and all other items—except those marked by the Owner to remain—off the site and in conformance with all existing applicable laws and regulations.

C. Pollution Controls

1. Use water sprinkling, temporary enclosures, and other suitable methods to limit the amount of dust and dirt rising and scattering in the air to the lowest practical level. Comply with governing regulations pertaining to environmental protection.

    a. Do not use water when it may create hazardous or objectionable conditions such as ice, flooding, and pollution.
    b. Clean adjacent structures, facilities, and improvements of dust, dirt, and debris caused by demolition operations. Return adjacent areas to conditions existing before starting the work.

3.02 STRUCTURAL REMOVALS

A. The Contractor shall remove structures to the lines and grades shown unless otherwise directed by the Engineer.

B. All demolition debris shall be removed and taken from the site, unless otherwise approved by the Engineer.

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

3.03 DEMOLITION, REPLACEMENT, AND REPAIR

A. Structural elements shall not be overstressed. The Contractor shall be responsible for shoring and/or bracing as required and indicated on the Drawings for adequate structural support as a result of work performed.

3.04 CLEAN-UP

A. The Contractor shall remove from the site all debris resulting from the demolition operations as it accumulates. Upon completion of the work, the Contractor shall remove all materials, equipment, waste, and debris of every sort and shall leave the premises clean, neat, and orderly.

END OF SECTION

SECTION 02370
EROSION AND SEDIMENTATION CONTROL

PART 1 GENERAL

1.01 SCOPE OF WORK

A. The Contractor shall take every reasonable precaution throughout construction to prevent the erosion of soil and the sedimentation of streams, bays, storm systems, or other water impoundments, ground surfaces, or other property as required by federal, state, and local regulations.

B. The Contractor shall provide protective covering for disturbed areas upon suspension or completion of land-disturbing activities. Permanent vegetation shall be established at the earliest practicable time. Temporary and permanent erosion-control measures shall be coordinated to ensure economical, effective, and continuous erosion and siltation control throughout the construction and post-construction period.

1.02 SUBMITTALS

A. The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance.

1.03 REFERENCE STANDARDS

Reference standards and recommended practices referred to in this Section shall be the latest revision of any such document in effect at the bid time. The following documents are a part of this Section. Where this Section differs from these documents, the requirements of this Section shall apply.

A. Florida Department of Transportation (FDOT)

1. FDOT Section 103—Temporary Work Structures.
2. FDOT Section 104—Prevention, Control, and Abatement of Erosion and Water Pollution.
3. FDOT Section 530—Revetment Systems.
4. FDOT Section 982—Fertilizer.
5. FDOT Section 985—Geosynthetic Materials.

B. City of Clearwater Technical Specifications

1. Section IV, Article 207—Erosion and Sedimentation Control.

1.04 REGULATORY REQUIREMENTS

A. The Contractor shall prevent damage to properties outside the construction limits from siltation due to construction of the project and assume all responsibilities to the affected property owners for correction of damages which may occur. Erosion-control measures shall be performed conforming to the requirements of and in accordance with plans approved by applicable state and local agencies and as specified by the erosion-control portion shown on the Drawings and as required by these Specifications. The Contractor shall not allow mud and debris to accumulate in the streets or enter drainage ditches, canals, or waterways. Should the Contractor pump water from excavations during construction, appropriate siltation preventative measures shall be taken before the pumped water is discharged into any drainage ditch, canal, or waterway.

1.05 PRACTICES

The Contractor shall adhere to the following:

A. Avoid dumping soil or sediment into any stream bed, pond, ditch, or watercourse.

B. Maintain an undisturbed vegetative buffer where possible between a natural watercourse and trenching and grading operations.

C. Avoid equipment crossings of streams, creeks, and ditches where practicable.

1.06 EROSION AND SEDIMENT-CONTROL DEVICES AND FEATURES

A. The Contractor shall construct all devices (silt fences, retention areas, etc.) for sediment control at the locations required to protect federal, state, and local water bodies and water courses and drainage systems before beginning to excavate the site. All devices shall be properly maintained in place until a structure or paving makes the device unnecessary or until directed to permanently remove the device.

B. The Contractor shall use mulch to temporarily stabilize areas subject to excessive erosion and to protect seed beds after planting where required.

C. Filter fabric, hay bales, or other approved methods shall be placed and secured over the grates of each existing inlet, grating, or storm pipe opening near the area of excavation to prevent silt and debris from entering the storm systems.

D. The Contractor shall use silt fences, hay bales, and floating turbidity barriers as shown on the plans or as directed by the Owner or Engineer to restrict movement of sediment from the site.

E. The Contractor shall establish vegetative cover on all unpaved areas disturbed by the work.

PART 2 PRODUCTS

2.01 GENERAL

A. Open-mesh biodegradable mulching cloth.

B. Fertilizer shall be 10-10-10 grade or equivalent.

C. Lime shall be Dolomitic Agricultural Ground limestone, in accordance with FDOT Section 982.

D. Silt fence shall consist of non-biodegradable filter fabric (Trevira, Mirafi, etc.), in accordance with FDOT Section 985, wired to galvanized wire mesh fencing and supported by wood or metal posts.

E. Floating or staked turbidity barriers as specified in FDOT Section 985 and FDOT Section 104.

F. Erosion Stone: FDOT Section 530.

1. Sand-Cement Riprap.
2. Concrete Block.
3. Rubble 20 to 300 pounds each.

G. Filter Fabric for placing under Riprap shall meet the requirements of FDOT Section 985.

H. Baled hay or straw in accordance with FDOT Section 104.

PART 3 EXECUTION

3.01 CLEARING

A. The Contractor shall schedule and perform clearing and grubbing so that subsequent grading operation and erosion-control practices can follow immediately after. Excavation, borrow, and embankment operations will be conducted as a continuous operation. All construction areas not otherwise protected shall be planted with permanent vegetative cover within 30 working days after completing active construction.

3.02 STABILIZING

A. The angle for graded slopes and fills shall be no greater than the angle that can be retained by vegetative cover or other adequate erosion-control devices or structures. All disturbed areas outside of embankment left exposed will, within 30 working days of completion of any phase of grading, be planted or otherwise provided with either temporary or permanent ground cover, devices, or structures sufficient to restrain erosion.

3.03 REGULATORY REQUIREMENTS

A. Whenever land-disturbing activity is undertaken on a tract, a ground cover sufficient to restrain erosion must be planted or otherwise provided within 30 working days on that portion of the tract upon which further active construction is to be undertaken.

B. If any earthwork is to be suspended for any reason for longer than 30 calendar days, the areas involved shall be seeded with vegetative cover or otherwise protected against excessive erosion during the suspension period. Suspension of work in any area of operation does not relieve the Contractor of the responsibility to control erosion in that area.

3.04 VEGETATIVE COVER

A. Preparation of Seedbed. Areas to be seeded shall be scarified a depth of 4 inches until a firm, well-pulverized, uniform seedbed is prepared. Fertilizer shall be applied during the scarification process in accordance with the following rates:

1. Fertilizer—10 to 15 pounds per 1,000 square feet.

B. The Contractor shall mulch all areas immediately after seeding. Mulch shall be applied and anchored as specified previously in this Section.

3.05 MAINTENANCE

A. The Contractor shall maintain all temporary and permanent erosion-control measures in functioning order. Temporary structures shall be maintained until such time as vegetation is firmly established and grassed areas shall be maintained until completion of the project. Areas which fail to show a suitable stand of grass or which are damaged by erosion shall be immediately repaired. No additional payment will be made to the Contractor for re-establishing erosion-control devices, which may become damaged, destroyed, or otherwise rendered unsuitable for their intended function during the construction of the project.

B. The Contractor shall remove all silt, sediment, and debris buildup regularly to maintain functioning storm systems and erosion-control devices.

3.06 REMOVAL OF SEDIMENT CONTROL DEVICES

A. Near completion of the project, when directed by the Engineer, the Contractor shall dismantle and remove the temporary devices used for sediment control during construction. All erosion-control devices in seeded areas shall be left in place until the grass is established. The Contractor shall seed areas around devices and mulch after removing or filling temporary control devices.

B. The Contractor shall clean up all areas at the completion of the project.

END OF SECTION

DIVISION 3

CONCRETE

SECTION 03600
GROUT

PART 1 GENERAL

1.01 SCOPE OF WORK

A. The Contractor shall furnish all labor, materials, equipment, and incidentals required and install grout complete as shown on the Drawings and as specified in this Section.

1.02 SUBMITTALS

A. The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance:

1. Commercially manufactured nonshrink cementitious grout. The submittal shall include catalog cuts, technical data, storage requirements, product life, working time after mixing, temperature considerations, conformity to required ASTM standards, and Material Safety Data Sheet.
2. Commercially manufactured nonshrink epoxy grout. The submittal shall include catalog cuts, technical data, storage requirements, product life, working time after mixing, temperature considerations, conformity to required ASTM standards, and Material Safety Data Sheet.
3. Cement grout. The submittal shall include the type and brand of the cement, the gradation of the fine aggregate, product data on any proposed admixtures, and the proposed mix of the grout.
4. Concrete grout. The submittal shall include the mix design, constituent quantities per cubic yard, all pozzalan materials proposed with their chemical analysis, admixtures, coarse and fine aggregate analysis, cement chemical and physical analysis and the water/cement ratio.

B. Certifications: Certify that commercially manufactured grout products and concrete grout admixtures are suitable for use in contact with potable water after 30 days curing.

C. Qualifications: Grout manufacturers shall submit documentation that they have at least 10 years experience in the production and use of the proposed grouts which they will supply.

1.03 REFERENCE STANDARDS

Reference standards and recommended practices referred to in this Section shall be in accordance with the currently effective Florida Building Code (FBC). The following documents are a part of this Section. Where this Section differs from these documents, the requirements of this Section shall apply.

A. American Society for Testing and Materials (ASTM)

1. ASTM C33/C33M—Standard Specification for Concrete Aggregates.
2. ASTM C150/C150M—Standard Specification for Portland Cement.
3. ASTM C531—Standard Test Method for Linear Shrinkage and Coefficient of Thermal Expansion of Chemical-Resistant Mortars, Grouts, Monolithic Surfacings, and Polymer Concretes.
4. ASTM C579—Standard Test Methods for Compressive Strength of Chemical-Resistant Mortars, Grouts, Monolithic Surfacings, and Polymer Concretes.
5. ASTM C827/C827M—Standard Test Method for Change in Height at Early Ages of Cylindrical Specimens of Cementitious Mixtures.
6. ASTM C1107/C1107M—Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink).
7. ASTM D695—Standard Test Method for Compressive Properties of Rigid Plastics.

B. US Army Corps of Engineers Standard (CRD)

1. CRD C-621—Corps of Engineers Specification for Non-Shrink Grout.

1.04 QUALITY ASSURANCE

A. Pre-installation Conference

1. Well in advance of grouting, the Contractor shall hold a pre-installation meeting to review the requirements for surface preparation, mixing, placing, and curing procedures for each product proposed for use. Parties concerned with grouting shall be notified of the meeting at least 10 days before its scheduled date.

B. Services of Manufacturer's Representative

1. A qualified field technician of the nonshrink grout manufacturer, specifically trained in installing the products, shall attend the pre-

installation conference and shall be present for the initial installation of each type of nonshrink grout. Additional services shall also be provided as required to correct installation problems.

C. Field Testing

1. All field testing and inspection services required shall be provided by the Owner. The Contractor shall assist in the sampling of materials and shall provide any ladders, platforms, etc., for access to the work. The methods of testing shall comply in detail with the applicable ASTM Standards.
2. The field testing of concrete grout shall be performed on the following items and shall be tested by the Owner to verify conformity with this Section:

a. Concrete placements—compressive strength (cylinders), compressive strength (cores), slump, and air content.

(1) Compressive strength testing cylinders shall be taken at the site and a minimum of four shall be prepared. Two shall be tested at 7 days and one tested at 28 days. One shall be kept as a spare to be tested at a future date chosen by the EOR or Owner.

1.05 WARRANTIES

A. Warranties shall be in accordance with the Supplementary Conditions of the Construction Contract, Section 01000, Project Requirements, and Section 01780, Warranties and Bonds.

1.06 DELIVERY, STORAGE, AND HANDLING

A. The Contractor shall adhere to the requirements specified in Section 01650, Delivery, Storage, and Handling, for storing and protecting the items specified in this Section.

B. Deliver materials to the jobsite in original, unopened packages, clearly labeled with the manufacturer's name, product identification, batch numbers, and printed instructions.

C. Store materials in full compliance with the manufacturer's recommendations. Total storage time from the date of manufacture to the date of installation shall be limited to 6 months or the manufacturer's recommended storage time, whichever is less.

D. Material which becomes damp or otherwise unacceptable shall be immediately removed from the site and replaced with acceptable material at no additional expense to the Owner.

E. Nonshrink-cement-based grouts shall be delivered as preblended, prepackaged mixes requiring only the addition of water.

F. Nonshrink epoxy grouts shall be delivered as premeasured, prepackaged, three-component systems requiring only blending as directed by the manufacturer.

1.07 QUALIFICATIONS

A. The grout manufacturer shall have a minimum of 10 years experience in the production and use of the type of grout proposed for the work.

1.08 DEFINITIONS

A. Nonshrink Grout: A commercially manufactured product that does not shrink in either the plastic or hardened state, is dimensionally stable in the hardened state, and bonds to a clean base plate.

PART 2 PRODUCTS

2.01 GENERAL

A. The use of a manufacturer's name and product or catalog number is to establish the standard of quality desired.

B. To standardize appearance, like materials shall be the products of one manufacturer or supplier.

2.02 MATERIALS

A. Nonshrink Cementitious Grout

1. Nonshrink cementitious grouts shall meet or exceed the requirements of ASTM C1107/C1107M, Grades B or C and CRD C-621. Grouts shall be Portland-cement based, contain a pre-proportioned blend of selected aggregates and shrinkage compensating agents, and shall require only the addition of water. Nonshrink cementitious grouts shall not contain

expansive cement or metallic particles. The grouts shall exhibit no shrinkage when tested in conformity with ASTM C827/C827M.

a. General purpose nonshrink cementitious grout shall conform to the standards stated above and shall be SikaGrout 212 by Sika Corp.; Set Grout by Master Builders, Inc.; Gilco Construction Grout by Gifford Hill & Co.; Euco NS by The Euclid Chemical Co.; NBEC Grout by U.S. Grout Corp.; or equal.

b. Flowable (Precision) nonshrink cementitious grout shall conform to the standards stated above and shall be Masterflow 928 by Master Builders, Inc.; Hi Flow Grout by the Euclid Chemical Co.; SikaGrout 212 by Sika Corp.; Supreme Grout by Gifford Hill & Co.; Five Star Grout by U. S. Grout Corp.; or equal.

B. Nonshrink Epoxy Grout

1. Nonshrink epoxy based grout shall be a pre-proportioned, three-component, 100% solids system consisting of epoxy resin, hardener, and blended aggregate. It shall have a compressive strength of 14,000 psi in 7 days when tested in conformity with ASTM D695 and have a maximum thermal expansion of 30x10-6 when tested in conformity with ASTM C531. The grout shall be Ceilcote 648 CP by Master Builders Inc.; Five Star Epoxy Grout by US Grout Corp.; Sikadur 42 Grout Pak by Sika Corp.; High Strength Epoxy Grout by the Euclid Chemical Co.; or equal.

C. Cement Grout

1. Cement grouts shall be a mixture of one part Portland cement conforming to ASTM C150/C150M, Types I, II, or III and 1 to 2 parts sand conforming to ASTM C33/C33M with sufficient water to place the grout. The water content shall be sufficient to impart workability to the grout but not to the degree that it will allow the grout to flow.

D. Concrete Grout

1. Concrete grout shall be proportioned with cement, coarse and fine aggregates, water, water reducer, and an air-entraining agent to produce a mix having an average strength of 4,000 psi at 28 days. Coarse aggregate size shall be 3/8 inch maximum. Slump should not exceed 5 inches and should be as low as practical yet still retain sufficient workability. The w/c ratio shall be a maximum of 0.44.

E. Water

1. Potable water, free from injurious amounts of oil, acid, alkali, organic matter, or other deleterious substances.

PART 3 EXECUTION

3.01 PREPARATION

A. Grout shall be placed over cured concrete that has attained its full design strength unless otherwise approved by the Engineer.

B. Concrete surfaces to receive grout shall be clean and sound, free of ice, frost, dirt, grease, oil, curing compounds, laitance and paints, and free of all loose material or foreign matter which may affect the bond or performance of the grout.

C. Roughen concrete surfaces by chipping, sandblasting, or other mechanical means to ensure bond of the grout to the concrete. Remove loose or broken concrete. Irregular voids or projecting coarse aggregate need not be removed if they are sound, free of laitance, and firmly embedded into the parent concrete.

1. Air compressors used to clean surfaces in contact with grout shall be the oilless type or equipped with an oil trap in the air line to prevent oil from being blown onto the surface.

D. Remove all loose rust, oil, or other deleterious substances from metal embedments or bottom of baseplates before installing the grout.

E. Concrete surfaces shall be washed clean and then kept moist for at least 24 hours before the placing of cementitious or cement grout. Saturation may be achieved by covering the concrete with saturated burlap bags, using a soaker hose, flooding the surface, or other method acceptable to the Engineer. Upon completion of the 24-hour period, visible water shall be removed from the surface before grouting. An adhesive bonding agent should only be used in lieu of surface saturation when approved by the Engineer for each specific location of grout installation.

F. Epoxy-based grouts do not require the saturation of the concrete substrate. Surfaces in contact with epoxy grout shall be completely dry before grouting.

G. Construct grout forms or other leak-proof containment as required. Forms shall be lined or coated with release agents recommended by the grout manufacturer.

Forms shall be of adequate strength, securely anchored in place, and shored to resist the forces imposed by the grout and its placement.

1. Forms for epoxy grout shall be designed to allow the formation of a hydraulic head and shall have chamfer strips built into forms.

H. Level and align the structural or equipment bearing plates in accordance with the structural requirements and the recommendations of the equipment manufacturer.

I. Equipment shall be supported during alignment and installation of grout by shims, wedges, blocks, or other approved means. The shims, wedges, and blocking devices shall be prevented from bonding to the grout by appropriate bond breaking coatings and removed after grouting unless otherwise approved by the Engineer.

3.02 INSTALLATION—GENERAL

A. The Contractor shall mix, apply, and cure products in strict compliance with the manufacturer's recommendations and this Section.

B. Have sufficient manpower and equipment available for rapid and continuous mixing and placing. Keep all necessary tools and materials ready and close at hand.

C. Maintain temperatures of the foundation plate, supporting concrete, and grout between 40 and 90ºF during grouting and for at least 24 hours after or as recommended by the grout manufacturer, whichever is longer. Take precautions to minimize differential heating or cooling of baseplates and grout during the curing period.

D. Take special precautions for hot weather or cold weather grouting as recommended by the manufacturer when ambient temperatures and/or the temperature of the materials in contact with the grout are outside of the 60 and 90ºF range.

E. Install grout in a manner which will preserve the isolation between the elements on either side of the joint where grout is placed in the vicinity of an expansion or contraction joint.

F. Reflect all existing underlying expansion, contraction, and construction joints through the grout.

3.03 INSTALLATION—CEMENT GROUTS AND NONSHRINK CEMENTITIOUS GROUTS

A. Mix in accordance with the manufacturer's recommendations. Do not add cement, sand, pea gravel, or admixtures without prior approval by the Engineer.

B. Avoid mixing by hand. Mixing in a mortar mixer (with moving blades) is recommended. Pre-wet the mixer and empty excess water. Add premeasured amount of water for mixing, followed by the grout. Begin with the minimum amount of water recommended by the manufacturer and then add the minimum additional water required to obtain workability. Do not exceed the manufacturer's maximum recommended water content.

C. Placements greater than 3 inches deep shall include the addition of clean, washed pea gravel to the grout mix when approved by the manufacturer. Comply with the manufacturer's recommendations for the size and amount of aggregate to be added.

D. Place grout into the designated areas in a manner which will avoid segregation or entrapment of air. Do not vibrate grout to release air or to consolidate the material. Placement should proceed in a manner which will ensure the filling of all spaces and provide full contact between the grout and adjoining surfaces. Provide grout holes as necessary.

E. Place grout rapidly and continuously to avoid cold joints. Do not place cement grouts in layers. Do not add additional water to the mix (retemper) after initial stiffening.

F. Just before the grout reaches its final set, cut back the grout to the substrate at a 45º angle from the lower edge of the bearing plate unless otherwise approved by the Engineer. Finish this surface with a wood float (brush) finish.

G. Begin curing immediately after form removal, cutback, and finishing. Keep grout moist and within its recommended placement temperature range for at least 24 hours after placement or longer if recommended by the manufacturer. Saturate the grout surface by use of wet burlap, soaker hoses, ponding, or other approved means. Provide sunshades as necessary. If drying winds inhibit the ability of a given curing method to keep grout moist, erect wind breaks until wind is no longer a problem or curing is finished.

3.04 INSTALLATION—NONSHRINK EPOXY GROUTS

A. Mix in accordance with the procedures recommended by the manufacturer. Do not vary the ratio of components or add solvent to change the consistency of the

grout mix. Do not overmix. Mix full batches only to maintain proper proportions of resin, hardener, and aggregate.

B. Monitor ambient weather conditions and contact the grout manufacturer for special placement procedures to be used for temperatures below 60 or above 90ºF.

C. Place grout into the designated areas in a manner which will avoid trapping air. Placement methods shall ensure the filling of all spaces and provide full contact between the grout and adjoining surfaces. Provide grout holes as necessary.

D. Minimize "shoulder" length (extension of grout horizontally beyond base plate). In no case shall the shoulder length of the grout be greater than the grout thickness.

E. Finish grout by puddling to cover all aggregate and provide a smooth finish. Break bubbles and smooth the top surface of the grout in conformity with the manufacturer's recommendations.

F. Epoxy grouts are self curing and do not require the application of water. Maintain the formed grout within its recommended placement temperature range for at least 24 hours after placing, or longer if recommended by the manufacturer.

3.05 INSTALLATION—CONCRETE GROUT

A. Screed underlying concrete to the grade shown on the Drawings. Provide the surface with a broomed finish, aligned to drain. Protect and keep the surface clean until placement of concrete grout.

B. Remove the debris and clean the surface by sweeping and vacuuming all dirt and other foreign materials. Wash the tank slab using a strong jet of water. Flushing debris into tank drain lines will not be permitted.

C. Saturate the concrete surface for at least 24 hours before placing the concrete grout. Saturation may be maintained by ponding, by the use or soaker hoses, or by other methods acceptable to the Engineer. Remove excess water just before placing the concrete grout. Place a cement slurry immediately ahead of the concrete grout so that the slurry is moist when the grout is placed. Work the slurry over the surface with a broom until it is coated with approximately 1/16- to 1/8-inch-thick cement paste.

D. Provide grout contraction joints as indicated on the Drawings.

E. Finish and cure the concrete grout as specified by the given equipment manufacturer. The grout shall be wet cured at a minimum for 7 days.

3.06 SCHEDULE

A. The following list indicates where the particular types of grout are to be used:

1. General purpose nonshrink cementitious grout: Use at all locations where nonshrink grout is called for on the plans except for base plates greater than 3 feet wide by 3 feet long and, except for the setting of anchor rods, anchor bolts or reinforcing steel in concrete.
2. Flowable nonshrink cementitious grout: Use under all base plates greater in area than 3 feet by 3 feet. Use at all locations indicated to receive flowable nonshrink grout by the Drawings. The Contractor, at his/her option and convenience, may also substitute flowable nonshrink grout for general purpose nonshrink cementitious grout.
3. Nonshrink epoxy grout: Use for setting anchor rods, anchor bolts, and reinforcing steel in concrete and for all locations specifically indicated to receive epoxy grout.
4. Cement grout: Cement grout may be used for grouting incidental base plates for structural and miscellaneous steel such as post base plates for platforms, base plates for beams, etc. It shall not be used when nonshrink grout is specifically called for on the Drawings or for grouting primary structural steel members such as columns and girders.
5. Concrete grout: Where indicated on the Drawings.

END OF SECTION

DIVISION 9

FINISHES

SECTION 09900
PAINTING AND COATING

PART 1 GENERAL

1.01 SCOPE OF WORK

A. This Section includes materials for and application of painting and coating systems for the following surfaces:

1. Submerged metal.
2. Buried and aboveground metal.
3. Submerged concrete and masonry.
4. Exposed concrete and masonry.
5. Nonferrous, galvanized, and other miscellaneous metals.

1.02 SUBMITTALS

A. The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance.

B. Submit manufacturer’s data sheets showing the following information:

1. Percent solids by volume (sbv).
2. Minimum and maximum recommended dry-film thickness per coat for prime, intermediate, and finish coats.
3. Recommended surface preparation.
4. Recommended thinners.
5. Statement verifying that the specified prime coat is recommended by the manufacturer for use with the specified intermediate and finish coats.
6. Application instructions including recommended equipment and temperature limitations.
7. Curing requirements and instructions.

C. Submit color swatches.

D. Submit certificate identifying the type and gradation of abrasives used for surface preparation.

E. Submit material safety data sheets for each coating.

1.03 REFERENCE STANDARDS

Reference standards and recommended practices referred to in this Section shall be the latest revision of any such document in effect at the bid time. The following documents are a part of this Section. Where this Section differs from these documents, the requirements of this Section shall apply.

A. American Architectural Manufacturers Association (AAMA)

1. AAMA 2604—Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix).

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

1. AASHTO T-259—Standard Method of Test for Resistance of Concrete to Chloride Ion Penetration.

C. American Society for Testing and Materials (ASTM)

1. ASTM A780/A780M—Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.
2. ASTM B117—Standard Practice for Operating Salt Spray (Fog) Apparatus.
3. ASTM C67/C67M—Standard Test Methods for Sampling and Testing Brick and Structural Clay Tile.
4. ASTM C97/C97M—Standard Test Methods for Absorption and Bulk Specific Gravity of Dimension Stone.
5. ASTM C140/C140M—Standard Test Methods for Sampling and Testing Concrete Masonry Units and Related Units.
6. ASTM C307—Standard Test Method for Tensile Strength of Chemical-Resistant Mortar, Grouts, and Monolithic Surfacings.
7. ASTM C501—Standard Test Method for Relative Resistance to Wear of Unglazed Ceramic Tile by the Taber Abraser.
8. ASTM C518—Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Apparatus.
9. ASTM C579—Standard Test Methods for Compressive Strength of Chemical-Resistant Mortars, Grouts, Monolithic Surfacings, and Polymer Concretes.
10. ASTM C580—Standard Test Method for Flexural Strength and Modulus of Elasticity of Chemical-Resistant Mortars, Grouts, Monolithic Surfacings, and Polymer Concrete.
11. ASTM C793—Standard Test Method for Effects of Laboratory Accelerated Weathering on Elastomeric Joint Sealants.

12. ASTM D520—Standard Specification for Zinc Dust Pigment.
13. ASTM D522/D522M—Standard Test Methods for Mandrel Bend Test of Attached Organic Coatings.
14. ASTM D638—Standard Test Method for Tensile Properties of Plastics.
15. ASTM D695—Standard Test Method for Compressive Properties of Rigid Plastics.
16. ASTM D790—Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.
17. ASTM D870—Standard Practice for Testing Water Resistance of Coatings Using Water Immersion.
18. ASTM D1002—Standard Test Method for Apparent Shear Strength of Single-Lap-Joint Adhesively Bonded Metal Specimens by Tension Loading (Metal-to-Metal).
19. ASTM D1014—Standard Practice for Conducting Exterior Exposure Tests of Paints and Coatings on Metal Substrates.
20. ASTM D1308—Standard Test Method for Effect of Household Chemicals on Clear and Pigmented Coating Systems.
21. ASTM D2240—Standard Test Method for Rubber Property—Durometer Hardness.
22. ASTM D2370—Standard Test Method for Tensile Properties of Organic Coatings.
23. ASTM D2697—Standard Test Method for Volume Nonvolatile Matter in Clear or Pigmented Coatings.
24. ASTM D2794—Standard Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact).
25. ASTM D3273—Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber.
26. ASTM D3734—Standard Specification for High-Flash Aromatic Naphthas.
27. ASTM D4060—Standard Test Method for Abrasion Resistance of Organic Coatings by the Taber Abraser.
28. ASTM D4138—Standard Practices for Measurement of Dry Film Thickness of Protective Coating Systems by Destructive, Cross-Sectioning Means.
29. ASTM D4141/D4141M—Standard Practice for Conducting Black Box and Solar Concentrating Exposures of Coatings.
30. ASTM D4258—Standard Practice for Surface Cleaning Concrete for Coating.
31. ASTM D4260—Standard Practice for Liquid and Gelled Acid Etching of Concrete.
32. ASTM D4261—Standard Practice for Surface Cleaning Concrete Masonry Units for Coating.
33. ASTM D4263—Standard Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method.

34. ASTM D4541—Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers.
35. ASTM D4585/D4585M—Standard Practice for Testing Water Resistance of Coatings Using Controlled Condensation.
36. ASTM D4587—Standard Practice for Fluorescent UV-Condensation Exposures of Paint and Related Coatings.
37. ASTM D4787—Standard Practice for Continuity Verification of Liquid or Sheet Linings Applied to Concrete Substrates.
38. ASTM D5590—Standard Test Method for Determining the Resistance of Paint Films and Related Coatings to Fungal Defacement by Accelerated Four-Week Agar Plate Assay.
39. ASTM D5894—Standard Practice for Cyclic Salt Fog/UV Exposure of Painted Metal, (Alternating Exposures in a Fog-Dry Cabinet and a UV/Condensation Cabinet).
40. ASTM D6386—Standard Practice for Preparation of Zinc (Hot-Dip Galvanized) Coated Iron and Steel Product and Hardware Surfaces for Painting.
41. ASTM D6695—Standard Practice for Xenon-Arc Exposures of Paint and Related Coatings.
42. ASTM D6904—Standard Practice for Resistance to Wind-Driven Rain for Exterior Coatings Applied on Masonry.
43. ASTM D7091—Standard Practice for Nondestructive Measurement of Dry Film Thickness of Nonmagnetic Coatings Applied to Ferrous Metals and Nonmagnetic, Nonconductive Coatings Applied to Non-Ferrous Metals.
44. ASTM D7234—Standard Test Method for Pull-Off Adhesion Strength of Coatings on Concrete Using Portable Pull-Off Adhesion Testers.
45. ASTM E84—Standard Test Method for Surface Burning Characteristics of Building Materials.
46. ASTM F1869—Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.
47. ASTM G210—Standard Practice for Operating the Severe Wastewater Analysis Testing Apparatus.

D. American Water Works Association (AWWA)

1. AWWA C203—Coal-Tar Protective Coatings and Linings for Steel Water Pipelines – Enamel and Tape – Hot Applied.
2. AWWA C209—Cold-Applied Tape Coatings for Steel Water Pipe, Special Sections, Connections, and Fittings.

E. British Standards Institution (BSI)

1. BS EN 598—Ductile Iron Pipes, Fittings, Accessories, and their Joints for Sewerage Applications – Requirements and Test Methods.

F. National Association of Corrosion Engineers International (NACE)

1. NACE SP0188—Discontinuity (Holiday) Testing of New Protective Coatings on Conductive Substrates.
2. NACE TM0174—Laboratory Methods for the Evaluation of Protective Coatings and Lining Materials on Metallic Substrates in Immersion Service.

G. NSF International (NSF)

1. NSF 61—Drinking Water System Components – Health Effects.

H. Society for Protective Coatings (SSPC) and National Association of Corrosion Engineers (NACE)

1. SSPC PA-1—Shop, Field, and Maintenance Painting of Steel.
2. SSPC PA-2—Procedure for Determining Conformance to Dry Coating Thickness Requirements.
3. SSPC SP-1—Solvent Cleaning.
4. SSPC SP-2—Hand Tool Cleaning.
5. SSPC SP-3—Power Tool Cleaning.
6. SSPC SP-5/NACE No. 1—White Metal Blast Cleaning.
7. SSPC SP-6/NACE No. 3—Commercial Blast Cleaning.
8. SSPC SP-7/NACE No. 4—Brush-Off Blast Cleaning.
9. SSPC SP-8—Pickling.
10. SSPC SP-10/NACE No. 2—Near-White Blast Cleaning.
11. SSPC SP-11—Power Tool Cleaning to Bare Metal.
12. SSPC SP-12/NACE No. 5—High- and Ultra-High-Pressure Water Jetting.
13. SSPC SP-13/NACE No. 6—Surface Preparation of Concrete.
    a. ICRI CSP1-6—Concrete Surface Profile 1 – 6.
14. SSPC SP-14/NACE No. 8—Industrial Blast Cleaning.
15. SSPC SP WJ-1—Waterjet Cleaning of Metals – Clean to Bare Substrate.
16. SSPC SP WJ-2—Waterjet Cleaning of Metals – Very Thorough Cleaning.
17. SSPC SP WJ-3—Waterjet Cleaning of Metals – Thorough Cleaning.
18. SSPC SP WJ-4—Waterjet Cleaning of Metals – Light Cleaning.

I. US Department of Defense (MIL)

1. MIL-C-5541—Chemical Conversion Coatings on Aluminum and Aluminum Alloys.
2. MIL-C-18480B—Coating Compound, Bituminous, Solvent, Coal-Tar Base.
3. MIL-D-3134—Deck Covering Materials.
4. MIL-DTL-24441—General Specification for Paint, Epoxy-Polyamide.
5. MIL-P-21035—Paint High Zinc Dust Content, Galvanizing Repair.

PART 2 MATERIALS

2.01 PAINTING AND COATING SYSTEMS

The following index lists the various painting and coating systems by service and generic type:

PAINT COATINGS SYSTEM INDEX		
No.	Title	Generic Coating
Submerged Metal Coating Systems		
2.	Submerged Metal, Mild to Moderate Wastewater, Raw Water (Nonpotable) or Raw Sewage in Aerobic Environments	Zinc+MIO blend urethane/Cycloaliphatic amine epoxy
5.	Submerged Metal Requiring Extremely High Abrasion Resistance, Raw Sewage or Grit Slurries	Epoxy-ceramic
Metal Coating Systems		
21.	Metal, Standard Pipe Coating System (Suitable for Buried and Aboveground)	Epoxy/epoxy/epoxy
Submerged Concrete and Masonry Coating Systems		
32.	Exposed Concrete and Masonry, Mild to Moderate Corrosive Environment	Modified polyamine epoxy
Exterior/UV-Exposed Concrete and Masonry Coating Systems		
42.	Existing or Coating Concrete and Masonry, Atmospheric Weathering Environment	Acrylic emulsion/acrylic emulsion
Nonferrous, Galvanized, and Other Miscellaneous Metals Coating Systems		
62.	Galvanized Steel, Stainless Steel, Aluminum, or Copper	Low-Stress Epoxy/ Aliphatic Polyurethane/ Aliphatic Polyurethane

A. These systems are specified in detail in the following paragraphs. For each system, the required surface preparation, coating materials, and thickness are described. If the specified surface preparation, coating materials, or thickness differs from the coating manufacturer's written instructions at the time of application, the manufacturer's instructions shall govern.

B. Only products of one manufacturer may be used throughout any particular coating system.

C. The following products are listed as a reference standard for this Section. All high-performance coatings shall be a product of Tnemec International or Induron. No other manufacturers will be permitted with prior approval of the Engineer.

D. To be considered for approval, potential alternate products must:

1. Be submitted by the manufacturer a minimum of 10 days before the project bid date to allow time for review.
2. Be the same generic type and have the same solids by volume (sbv).
3. Maintain the specified total dry film thickness.
4. Meet or exceed the performance criteria of the originally specified coatings in Article 2.02 of this Section.
5. Include a side-by-side comparison of equality including generic coating description, volume solids, ASTM performance test results, etc.
6. Be endorsed by the manufacturer for their intended use on the project.

E. All dry film thicknesses in the coating systems below are listed in mils.

F. Submerged Metal Coating Systems

1. System No. 2—Submerged Metal, Mild to Moderate Wastewater, Raw Water (Nonpotable) or Raw Sewage in Aerobic Environments:

a. Type: Tnemec Series 104 Cycloaliphatic Amine Epoxy (82% sbv) with a Series 1 Omnithane Zinc/Micaceous Iron Oxide Blend Modified Aromatic Polyurethane Primer (61% sbv) at a total film thickness of 14.5 to 19.5 mils.
b. Service Conditions: For use with metal pipes or structures (such as scum troughs, sluice gates, clarifier mechanisms, or piping) continuously submerged in mild to moderate (aerobic) wastewater conditions, such as clarifiers, chlorine contact basins, aeration basins, settling basins, and other open-top structures.
c. Surface Preparation: Solvent clean in accordance with SSPC SP-1 to remove contaminants from the surface; abrasive blast in accordance with SSPC SP-10/NACE No. 2.
d. Prime Coat: Tnemec Series 1 Omnithane at 2.5 to 3.5 mils.
e. Stripe Coat (Weld Seams and Edges): Tnemec Series 104 Hi-Build Epoxoline at 4.0 to 6.0 mils.
f. Intermediate Coat: Tnemec Series 104 Hi-Build Epoxoline at 6.0 to 8.0 mils.

g. Finish Coat: Tnemec Series 104 Hi-Build Epoxoline at 6.0 to 8.0 mils.

2. System No. 5—Submerged Metal Requiring Extremely High Abrasion Resistance, Raw Sewage or Grit Slurries:

a. Type: Two-component epoxy resin/ceramic having 100% volume solids and having the following characteristics:

Tensile shear adhesion (ASTM D1002):	2,500 psi (min)
Shore D hardness (minimum):	85
Abrasion resistance (ASTM D4060):	0.8 mg (max) loss per 1,000 cycles

b. Service Conditions: For use as a lining for pump volutes, pump impellers, piping, valves, and heat exchanger tubes subject to severe abrasion service.

c. Surface Preparation: Solvent clean in accordance with SSPC SP-1 to remove contaminants from the surface. Abrasive blast in accordance with SSPC SP-10/NACE No. 2.

d. Coating System: Apply two coats (each a different color) to a minimum thickness of 10 mils per coat. Minimum total coating thickness shall be 20 mils. Product: THORTEX Cerami-Tech C.R. as applied by Western Industrial Technology, Inc., Fullerton, California, or Paragon Industries, Horsham, Pennsylvania; Belzona 1341; or equal.

G. Buried Metal Coating Systems

1. System No. 21—Buried Metal:

a. Type: Polyamidoamine Epoxy (67% sbv) primer, intermediate and finish coat with a UV-stable Finish Coat option for exposed non-immersion areas. Total film thickness is 11.0 to 24.0 mils.

b. Service Conditions: Metal, such as pipe exteriors, valves, flanges, bolts, nuts, structural steel, and fittings.

c. Surface Preparation (new): New metals are to arrive shop-blasted and primed with Series N140. Upon delivery, solvent clean in accordance with SSPC-SP1 Solvent Cleaning and abrasive blast or

mechanically abrade bare metals to provide an SSPC-SP10 Near-White Blast Cleaning finish.

d. Surface Preparation (existing): Abrasive blast or mechanically abrade existing metals to remove all pre-existing coatings and provide an SSPC-SP10 Near White Blast Cleaning finish with a minimum 1.5 mil angular anchor profile.

e. Prime Coat: Tnemec Series N69 at 4.0 to 8.0 mils.

f. Intermediate Coat: Tnemec Series N69 at 4.0 to 8.0 mils.

g. Finish Coat Option 1 (Immersion, Buried, or Splash/Spray Service): Tnemec Series N69 at 4.0 to 8.0 mils.

h. Finish Coat Option 2 (UV-exposed or non-immersion areas): Tnemec Series 1095 Endura-Shield at 3.0 to 5.0 mils. Series 1095 is semi-gloss. For a different sheen, apply Series 1094 (gloss) or Series 1096 (eggshell) at the same thickness.

H. Submerged Concrete and Masonry Coating Systems

1. System No. 32—Exposed Concrete and Masonry, Mild to Moderate Corrosive Environment:

a. Type: Glass Flake Reinforced Modified Polyamine Epoxy (82% sbv) 1st Coat. Acrylic Polyurethane 2nd coat above the waterline, at a total dry film thickness of 16.0 to 25.0 mils.

b. Service Conditions: Concrete and masonry exposed to mild to moderate corrosive atmospheres and immersion service, such as chlorine contact basins, chlorine storage areas, or open-top (aerobic) clarifiers, aeration basins, settling basins, etc.

c. Surface Preparation: Abrasive blast or mechanically abrade in accordance with SSPC-SP13 to remove all existing coatings and provide a minimum ICRI CSP 5 surface profile.

d. Resurfacing: Apply Tnemec Series 218 to all surfaces at a minimum 1/8-inch and as needed bring all surfaces to level. For localized repairs of large bugholes, honeycombs, and other cavities deeper than the recommended maximum thickness, clean sand or pea gravel may be post-added to Series 218. If more than 1/4-inch of repairs is needed, Series 217 may be used.

e. First Coat: Tnemec Series 142, applied in multiple passes to achieve a total film build of 16.0 to 20.0 dry mils.

f. Second Coat (Above the waterline, extending down 1 foot below the waterline): Tnemec Series 1094 at 3.0 to 5.0 mils.

I. Exterior/UV-Exposed Concrete and Masonry Coating Systems

1. System No. 42—Existing or Coating Concrete and Masonry, Atmospheric Weathering Environment:

a. Type: Tnemec Series 1026 Enduratone Acrylic Emulsion (43% sbv, 100% acrylic resin) primer and finish coat with a Series 156 Enviro-Crete Modified Waterborne Acrylate (50.9% sbv) brush into hairline cracks at a total dry film thickness of 4.0 to 6.0 mils.
b. Service Conditions: Exterior concrete or masonry, exposed to ultraviolet light and weathering, which requires excellent permeance (due to existing coatings already in place).
c. Surface Preparation: Remove all loose coatings, dirt, dust, grease, oil, mold, mildew, salts, and other soluble contaminants by high-pressure water cleaning (using potable water, minimum 3,500 psi, 3–5 gallons/minute, oscillating tip). Neutralize and remove all mold and mildew using a solution made by adding 2 ounces of tri-sodium phosphate and 8 ounces of sodium hypochlorite to 1 gallon warm water. Use a scouring powder, if necessary, to remove mildew spores and then perform a final rinse with potable water. Feather edges of well-adhered preexisting coatings. No loose or lifted edges shall remain. All surfaces shall be clean, dry, and free of contaminants prior to the application of any coatings.
d. Hairline Cracks: Brush Tnemec Series 156 into hairline cracks. Multiple passes may be required for deeper cracks.
e. Prime Coat: Tnemec Series 1026 Enviro-Crete at 2.0 to 3.0 mils.
f. Finish Coat: Tnemec Series 1026 Enviro-Crete at 2.0 to 3.0 mils.

J. Nonferrous, Galvanized, and Other Miscellaneous Metals Coating Systems

1. System No. 62—Galvanized Steel, Stainless Steel, Aluminum, or Copper:

a. Type: Tnemec Series 1095 Endura-Shield Aliphatic Acrylic Polyurethane (66% sbv) finish with a Series 108 (100% sbv) prime coat at a total dry film thickness of 5.0 to 10.0 mils.
b. Service Conditions: Coat area of material using this system. Consult with coating manufacturer for immersion service requirements.
c. Surface Preparation: Clean the surface in accordance with SSPC SP-1. Primer must be applied as soon as possible on the same day as surface preparation.
d. Prime Coat: Tnemec Series 108 at 1.0 to 2.0 mils.

e. Intermediate Coat: Tnemec Series 1095 Endura-Shield at 2.0 to 44.0 mils. Series 1095 is semi-gloss. For a different sheen, apply Series 1094 (gloss) or Series 1096 (eggshell) at the same thickness.
f. Finish Coat: Tnemec Series 66 at 2.0 to 4.0 mils.
g. Finish Coat: Tnemec Series 1095 Endura-Shield at 2.0 to 4.0 mils. Series 1095 is semi-gloss. For a different sheen, apply Series 1094 (gloss) or Series 1096 (eggshell) at the same thickness.

2.02 PERFORMANCE CRITERIA

The following shall serve as a basis of comparison for material substitution requests. Any substitutions which decrease the total film thickness, change the generic type of coating, or fail to meet the performance criteria of the specified materials shall not be approved.

A. Series 1 Omnithane – Zinc/Micaceous Iron Oxide Urethane

1. Adhesion: ASTM D4541 (Method B, Type II) – No less than 1,433 psi (9.88 MPa) adhesion, average of three tests.
2. Salt Spray (Fog): ASTM B117 – No blistering, cracking, or delamination of film. No more than .03% rusting on plane and no more than 3/16-inch rust creepage at scribe after 10,000 hours exposure.

B. Series 22 Epoxoline – Modified Polyamine Epoxy

1. Special Qualification: Certified by NSF International in accordance with NSF 61.
2. Product must be able to be applied in one single-coat application from 16.0 to 40.0 mils dry film thickness.
3. VOC Content: 0.10 pound/gallon (12 grams/liter).
4. Immersion: ASTM 870 – No blistering, cracking, rusting, or delamination of film after 2,000 hours continuous immersion in deionized water at 140°F (60°C), average of three tests.

C. Series 46H-413 Hi-Build Tneme-Tar – Polyamide Epoxy-Coal Tar

1. Adhesion: ASTM D4541 – Exceeds the cohesive strength of the concrete substrate (400 psi), average of three tests.
2. Abrasion: ASTM D4060 (CS-17 wheel, 1,000 gram load) – No more than 142 mg loss after 1,000 cycles.
3. Salt Spray (Fog): ASTM B117 – No blistering, cracking, checking, rusting, or delamination of film. No rust creepage at scribe after 9,000 hours continuous exposure.

D. Series 66 Hi-Build Epoxoline – Polyamide Epoxy

1. Adhesion: ASTM D4541 – No less than 1,930 psi (13.31 MPa) pull, average of three tests.
2. Salt Spray: ASTM B117 – No blistering, cracking, checking, or delamination of film. No more than 1/8-inch rust creepage at scribe after 8,000 hours exposure.

E. Series 90-07 Tneme-Zinc – Aromatic Zinc-Rich Urethane

1. Zinc Pigment: 83% by weight in dried film.
2. Adhesion: ASTM D4541 (Type II) – No less than 1,442 psi (9.94 MPa) adhesion, average of three tests.
3. Salt Spray: ASTM B117 – No blistering, cracking, or delamination of film. No more than 1/8-inch creepage at scribe and no more than 1% rusting on plane after 50,000 hours exposure.

F. Series 94H2O Hydro-Zinc – Zinc-Rich Aromatic Urethane

1. Special Qualification: Certified in accordance with NSF 61 for use on interior potable water tanks of 500 gallons or greater.
2. Zinc Pigment: 83% by weight in dried film.
3. Adhesion: ASTM D4541 (Type V Self-Aligning Adhesion Tester) – No less than 1,713 psi adhesion, average of three tests.
4. Salt Spray: ASTM B117 – No blistering, cracking, or delamination of film. No rusting on plane and no more than 1/16-inch rust creepage at scribe after 10,000 hours.

G. Series 104 HS Epoxy – Cycloaliphatic Amine Epoxy

1. Adhesion: ASTM D4541 – No less than 900 psi (6.21 MPa) pull, average of three tests.
2. Chemical Immersion: NACE TM0174, Procedure B – No blistering, cracking, or delamination of film after 7 days.
3. Salt Spray (Fog): ASTM B117 – No blistering, cracking, rusting, or delamination of film. No more than 1/32-inch (0.8 mm) rust creepage at scribe after 1,500 hours exposure.

H. Series 115 Uni-Bond DF – Self-Crosslinking Hydrophobic Acrylic

1. Adhesion: ASTM D4541 (Method C – Type V Tester) – No less than 1,472 psi pull (10.15 MPa), average of three tests.

2. Salt Spray: ASTM B117 – No more than 1/64-inch rust creepage at scribe, no more than 3% rusting on plane, and no less than a blister rating of 8 after 500 hours exposure.
3. Humidity: ASTM D4585/D4585M – No blistering, cracking, rusting, or delamination of film after 2,000 hours exposure.

I. Series N140 Pota-Pox Plus – Polyamidoamine Epoxy

1. Adhesion: ASTM D4541 – No less than 1,943 psi (13.40 MPa) pull, average of three tests.
2. Exterior Exposure: ASTM D1014 – No blistering, cracking, checking, rusting, or delamination of film. No rust creepage at scribe after 5 years exposure.
3. Humidity: ASTM D4585/D4585M – No blistering, cracking, or delamination of film after 10,000 hours exposure.
4. Immersion: ASTM D870 – No blistering, cracking, rusting, or delamination of film after 2,000 hours continuous immersion in deionized water at 140°F, average of three tests.
5. Salt Spray (Fog): ASTM B117 (Two Coats Series N140) – No blistering, cracking, or delamination of film. No more than 1% rusting on plane. No more than 1/16-inch rust creepage at scribe after 6,700 hours exposure.
6. Salt Spray (Fog): ASTM B117 (Series 91H_2O and Two Coats Series N140) – No blistering, cracking, checking, or delamination of film. No more than 1% rusting on plane and no more than 3/16-inch rust creepage at scribe after 20,000 hours exposure.

J. Series 142 Epoxoline – Modified Polyamine Epoxy

1. Suitable for methanol immersion service.
2. Adhesion: ASTM D4541 – No less than 2,042 psi (14.08 MPa) pull, average of three tests.
3. Salt Spray (Fog): ASTM B117 – No blistering, cracking, rusting, or delamination of film and less than 1/32-inch creepage at the scribe after 5,000 hours exposure.
4. Abrasion: ASTM D4060 – No more than 59.3 mg loss after 1,000 cycles, average of two tests.

K. Series 156 Enviro-Crete – Modified Waterborne Acrylate

1. Adhesion: ASTM D7234 – Exceeds the cohesive strength of concrete substrate (400 psi), average of three tests.
2. Salt Spray: ASTM B117 – No blistering, cracking, or delamination of film. No visible damage to coating or substrate after 5,000 hours.

3. QUV Exposure: ASTM D4587 (UVA-340 bulbs, 8 hours UV, 4 hours condensation) – No blistering, cracking, chalking, or delamination of the film. No less than 69% gloss retention, no more than 1.1 units gloss loss, and no more than 3.59 DE (FMC-2) color change (white) after 5,000 hours QUV exposure.
4. Fungal/Mold/Mildew Resistance: ASTM D3273 – No More than slight mold growth after 5 weeks exposure.
5. Tensile Strength, Elongation, Modulus of Elasticity: ASTM D2370 – Elongation no less than 200%, average of five tests. Tensile strength no less than 250 psi (1.7 MPa), average of three tests.
6. Wind Driven Rain Resistance: ASTM D6904 – No damage to coating or substrate. No visible moisture on the back of lightweight block after 48 hours exposure.

L. Series 239SC Chemblock – Modified Novolac Polyamine Epoxy

1. Chemical Immersion: NACE TM0174, Procedure B – No blistering, cracking, rusting, or delamination of film after 72 hours continuous contact with chemical.
2. Compressive Strength: ASTM C579 – Not less than 11,195 psi (77.19 MPa) compressive strength, average of six tests.
3. Flexural Strength and Modulus of Elasticity: ASTM D790 – Not less than 6,270 psi (43.23 MPa) flexural strength and 323,900 psi (2,233 MPa) flexural modulus of elasticity, average of five tests.
4. Impact: MIL D3134 (modified using 2.5 pound steel ball) – No more than 1/16-inch permanent indention. No cracking, checking, or delamination of film after 240 in-lb (27 J) direct impact, average of three tests.
5. Tensile Strength, Elongation, Modulus of Elasticity: ASTM D638 – No less than 7,913 psi (54.56 MPa) tensile strength, 222,975 psi (1,537 MPa) tensile modulus of elasticity and 6.14% elongation at break.

M. Series 241 Ultra-Tread MVT – Polyurethane Modified Concrete

1. Can be applied to 10-day old concrete.
2. Withstands moisture vapor transmission up to 20 pounds in accordance with ASTM F1869.
3. Withstands relative humidity up to 99% in accordance with ASTM F2170.
4. Adhesion: ASTM D7234 – Exceeds the cohesive strength of the concrete substrate (approximately 400 psi), average of three tests.
5. Compressive Strength: ASTM C579 – No less than 4,922 psi (33.94 MPa) compressive strength, average of six tests.
6. Flexural Strength and Modulus of Elasticity: ASTM C580 – No less than 2,438 psi (16.81 MPa) flexural strength and 313,614 psi (2,162 MPa) modulus of elasticity (tangent), average of five tests.

7. Tensile Strength: ASTM C307 – No less than 1,015 psi (7.00 MPa) tensile strength, average of six tests.

N. Series 248 Everthane – Aliphatic Moisture Cured Urethane

1. Chemical Resistance: Tnemec Test Method-59 (TTM-59) (ASTM D1308) (Covered Spot Test) – No blistering, cracking, checking, or delamination of film. No more than slight softening or very slight swelling and loss of gloss after 24 hours exposure to the following reagents: 30% Sulfuric Acid, 10% Hydrochloric Acid, 50% Phosphoric Acid, 10% Acetic Acid, 50% Sodium Hydroxide, 10% Ammonium Hydroxide, Methyl Ethyl Ketone, Ethyl Alcohol, Hexane, Xylene, Gasoline, Ethylene Glycol, Skydrol, Brake Fluid, Transmission Fluid, Aviation Gas, Jet Fuel (JP4).
2. Abrasion: ASTM D4060 (CS-17 Wheel, 1,000 gram load) – No more than 18 mg loss after 1,000 cycles, average of three tests.

O. Series 282 Tneme-Glaze – Polyamine Novolac Epoxy

1. Chemical Immersion: NACE TM0174, Procedure B – No blistering, cracking, rusting, or delamination of film after 72 hours continuous contact with chemical.
2. Compressive Strength: ASTM C579 – Not less than 11,195 psi (77.19 MPa) compressive strength, average of six tests.
3. Immersion: 140°F Deionized Water Immersion – No blistering, cracking, rusting, or delamination of film after 2,000 hours continuous immersion.
4. Impact: ASTM D2794 – No visible cracking or delamination of film after 59 in/lbs direct impact, average of three tests.
5. Salt Spray (Fog): ASTM B117 – No blistering, cracking, rusting, or delamination of film. No more than 1/16-inch rust creepage at scribe after 3,500 hours exposure.

P. Series 365 Tank Armor – Novolac Epoxy

1. Suitable for immersion service in 98% sulfuric acid.
2. Adhesion: ASTM D4541, Type II – No less than 1,650 psi (11.38 MPa) adhesion, average of three tests.
3. Hardness: ASTM D2240 (Shore D Durometer) – Not less than 90 Shore Type D hardness, average of five tests.

Q. Series 431 Perma-Shield PL – Modified Polyamine Ceramic Epoxy

1. Severe Wastewater Analysis Test: ASTM G210 – Initial impedance of 11.18 log-Z at 0.001 Hz (ohms cm^2). No blistering, cracking, checking, or delamination. No less than 88.7% EIS retention or not more than

1.26 ohms cm² reduction in log-Z electrochemical impedance at 0.001 Hz after 28 days exposure. No less than 2,363 psi (16.30 MPa) adhesion or no loss of adhesion after 28 days in S.W.A.T., average of three tests.

2. Abrasion Resistance: ASTM D4060 (CS-17 Wheel, 1,000 cycles, 1,000 gram load) – No more than 41 mg loss, average of three tests.
3. Abrasion Resistance: BS EN 598: 2007+A1: 2009 (Rocking Abrasion) – No more than 0.14 mm (5.5 mils) thickness of coating loss after 1,000,000 cycles.

R. Series 434 Perma-Shield H2S – Modified Aliphatic Amine Epoxy Mortar

1. Severe Wastewater Analysis Test: ASTM G210 – Initial impedance of 10.6 log-Z at 0.01 Hz (ohms cm²). No blistering, cracking, or checking. No less than 86.7% retention or not more than 1.4 ohms cm² reduction in log-Z electrochemical impedance at 0.01 Hz after 28 days exposure.
2. Abrasion Resistance: ASTM D4060 (CS-17 Wheel, 1,000 gram load) – No more than 88 mg loss after 1,000 cycles, average of three tests.
3. Impact: ASTM D2794 – No visible cracking or delamination after 160 inch-pounds (18.1 J) direct impact.
4. Compressive Strength: ASTM D695 – Not less than 12,331 psi (85.0 MPa) compressive strength, average of five tests.

S. Series 435 Perma-Glaze – Modified Polyamine Epoxy

1. Severe Wastewater Analysis Test: ASTM G210 – Initial impedance of 12.46 log-Z at 0.01 Hz (ohms cm²). No blistering, cracking, checking, or delamination. No less than 84.3% retention and no more than 1.95 ohms cm² reduction in electrochemical impedance after 28 days exposure. No less than 93% loss of tensile adhesion after 28 days in S.W.A.T. average of three tests.
2. Abrasion Resistance: ASTM D4060 (CS-17 Wheel, 1,000 gram load) – No more than 72 mg loss after 1,000 cycles, average of three tests.

T. Series 436 Perma-Shield FR – Fiber-Reinforced Modified Polyamine Epoxy

1. Severe Wastewater Analysis Test: ASTM G210 – Initial impedance of 10.2 log-Z at 0.01 Hz (ohms cm²). No blistering, cracking, or checking. No less than 83.7% retention or not more than 1.6 ohms cm² reduction in log-Z electrochemical impedance at 0.01 Hz after 28 days exposure.
2. Abrasion: ASTM D4060 (CS-17 Wheel, 1,000 gram load) – No more than 74.6 mg loss after 1,000 cycles, average of three tests.

3. Impact: ASTM D2794 – No visible cracking or delamination of film after 88 inch-pounds direct impact.
4. Compressive Strength: ASTM D695 – No less than 8,866 psi (6.13 MPa) compressive strength, average of five tests.

U. Series 626 Dur A Pell GS – RTV Silicone Rubber Water and Graffiti Protectant

1. Accelerated Weathering: ASTM C793 – No signs of deterioration except for dirt accumulation after 4,000 hours exposure.
2. Chloride Ion Penetration: AASHTO T-259 – No less than a 1500% reduction in the chloride ion content when compared to untreated concrete, average of two tests.

V. Series 662 Prime-A-Pell Plus – Modified Siloxane/Silane with Diffused Quartz Carbide

1. QUV Exposure: ASTM D4587 (UVA-340 bulbs, Cycle 4: 8 hours UV/4 hours condensation) – No reduction in water repellent performance after 5,000 hours exposure.
2. Water Absorption: ASTM C67/C67M (Applied to Ohio Sandstone) – No less than a 96% reduction in water absorption as compared to untreated samples following 24 hours of immersion.
3. Water Absorption: ASTM C97/C97M (Applied to Fire Clay Brick) – No less than a 93% reduction in water absorption as compared to untreated samples following 24 hours of immersion.
4. Water Absorption: ASTM C140/C140M (Applied to Cast Mortar Cubes) – No less than a 96% reduction in water absorption as compared to untreated samples following 24 hours of immersion.

W. Series 700 Hydroflon – Advanced Thermoset Solution Fluoropolymer

1. Exterior Exposure: ASTM D1014 (AAMA 2604) (South Florida Marine Exposure) – Exceeds the exterior weathering requirements of AAMA 2604 standard.
2. Exterior Exposure: ASTM D4141/D4141M, Method C (EMMAQUA) – No blistering, cracking, or chalking. No less than 100% gloss retention, no more than 1 unit gloss loss and no more than 0.23 DEHunter color change (white) after 1,500 MJ/m² (69,109MJ/m² total) EMMAQUA exposure.
3. QUV Exposure: ASTM D4587 – No blistering, cracking, or chalking. No less than 61% gloss retention (31.4 units gloss change) and 1.89 DEFMC2 (MacAdam units) color change (white) after 25,000 hours exposure.
4. Xenon Arc Weathering: ASTM D6695 – No blistering, cracking, or chalking. No less than 87% gloss retention (11.9 units gloss change) and

no greater than 0.37 DE00 color change (white) after 8,000 hours Xenon Arc exposure.

X. Series 971 Aerolon – Fluid-Applied Acrylic Insulation Coating

1. Immersion: ASTM D870 – No blistering, cracking, rusting, or delamination of film after 2,000 hours continuous immersion in deionized water at 140°F (60°C), average of three tests.
2. Thermal Conductivity: ASTM C518 – Thermal conductivity shall not be greater than 0.0356 W/m-°K or 0.2468 BTU-in/ft²-hr-°F (R-value at 1 inch equals 4.1).

Y. Series 1026 Enduratone – Acrylic Emulsion

1. VOC Content: 0.38 pounds/gallon (1.4 grams/liter).
2. QUV Exposure: ASTM D4587 (UVA-340 bulbs, 8 hours UV, 4 hours condensation) – No blistering, cracking, chalking, or delamination of film. No less than 49% gloss retention (2.3 units gloss change) and 0.39 DE00 color change after 10,000 hours exposure.

Z. Series 1029 Enduratone – HDP Acrylic Polymer

1. Algal Resistance: ASTM D5590 – No more than traces of fungal growth (less than 10%) after 3 weeks continuous exposure.
2. Fungal/Mold/Mildew Resistance: ASTM D5590 – No more than traces of fungal growth (less than 10%) after 4 weeks continuous exposure.
3. QUV Exposure: ASTM D4587 (UVA-340 bulbs, 8 hours UV, 4 hours condensation) – No blistering, cracking, or delamination of film. No less than 100% gloss retention, no more than 0.45 DE00 color change and no unit gloss loss after 3,000 hours.

AA. Series 1095 Endura-Shield – Aliphatic Acrylic Polyurethane

1. Volatile Organic Compounds (Thinned 5%): 0.77 pounds/gallon (92 grams/liter).
2. QUV Exposure: ASTM D4587 (UVA-340 bulbs, 8 hours UV, 4 hours condensation) – No blistering, cracking, or delamination. No less than 52% gloss retention or 23 units gloss change and 0.59 DECIE2000 color change (white) after 2,000 hours exposure.

PART 3 EXECUTION

3.01 WEATHER CONDITIONS

A. Do not paint in the rain, wind, snow, mist, or fog or when steel or metal surface temperatures are less than 5°F above the dew point.

B. Do not apply paint when the relative humidity is above 85% or otherwise outside the manufacturer's recommended level.

C. Do not paint when temperature of the substrate is outside of the manufacturers listed surface temperature requirement.

3.02 SURFACE PREPARATION PROCEDURES

A. Remove oil and grease from metal surfaces in accordance with SSPC SP-1. Use clean cloths and cleaning solvents and wipe dry with clean cloths. Do not leave a film or greasy residue on the cleaned surfaces before abrasive blasting. Powerwashing with a biodegradable degreaser is also acceptable.

B. Remove weld spatter and weld slag from metal surfaces and grind smoothly rough welds, beads, peaked corners, and sharp edges including erection lugs in accordance with SSPC SP-2 and SSPC SP-3. Grind 0.020 inch (minimum) off the weld caps on pipe weld seams. Grind outside sharp corners, such as the outside edges of flanges, to a minimum radius of 1/4 inch.

C. Remove sharp edges, burrs, and weld spatter.

D. Do not abrasive blast or prepare more surface area in 1 day than can be coated in 1 day; prepare surfaces and apply coatings the same day. For carbon steel, do not touch the surface between the time of abrasive blasting and the time the coating is applied. Prime all areas before rust bloom forms and within the same day.

E. Surface preparation shall conform to the SSPC Specifications and NACE Standards as follows:

Solvent Cleaning	SP-1
Hand Tool Cleaning	SP-2
Power Tool Cleaning	SP-3
White Metal Blast Cleaning	SP-5/NACE No. 1
Commercial Blast Cleaning	SP-6/NACE No. 3
Brush-Off Blast Cleaning	SP-7/NACE No. 3
Pickling	SP-8

Near-White Blast Cleaning	SP-10/NACE No. 2
Power Tool Cleaning to Bare Metal	SP-11
High- and Ultra-High-Pressure Water Jetting	SP-12/NACE No. 5
Surface Preparation of Concrete	SP-13/NACE No. 6
Industrial Blast Cleaning	SP-14/NACE No. 8
Waterjet Cleaning of Metals – Clean to Bare Substrate	SP WJ-1
Waterjet Cleaning of Metals – Very Thorough Cleaning	SP WJ-2
Waterjet Cleaning of Metals – Thorough Cleaning	SP WJ-3
Waterjet Cleaning of Metals – Light Cleaning	SP WJ-4

F. Wherever the words "solvent cleaning," "hand tool cleaning," "wire brushing," or "blast cleaning" or similar words are used in these Specifications or in the paint manufacturer's specifications, they shall be understood to refer to the applicable SSPC, surface preparation specifications listed above.

G. Brush-off blasting of concrete and masonry surfaces is defined as opening subsurface holes and voids and etching the surface for a coating to bond.

H. For carbon steel surfaces, after abrasive blast cleaning, the height of the surface profile shall be angular and from 2.0 to 3.0 mils unless specified otherwise. Verify the surface profile by measuring with an impresser tape acceptable to the Owner's Representative. Perform a minimum of one test per 100 square feet of surface area. Testing shall be witnessed by the Owner's Representative. The impresser tape used in the test shall be permanently marked with the date, time, and locations where the test was made. Test results shall be promptly presented to the Owner's Representative.

I. Do not apply any part of a coating system before the Owner's Representative has reviewed the surface preparation. If coating has been applied without this review, if directed by the Owner's Representative, remove the applied coating by abrasive blasting and reapply the coat in accordance with this Specification.

3.03 ABRASIVE BLAST CLEANING

A. Use dry abrasive blast cleaning for metal surfaces. Do not use abrasives in automatic equipment that have become contaminated. When shop or field blast cleaning with handheld nozzles, do not recycle or reuse blast particles.

B. After abrasive blast cleaning and before coating is applied, dry clean surfaces to be coated by dusting, sweeping, and vacuuming to remove residue from blasting.

C. Apply the specified primer or touch-up coating within an 8-hour working day. Do not apply coating over damp or moist surfaces. Reclean any blast-cleaned surface not coated within the 8-hour period before applying primer or touch-up coating.

D. Keep the area of the work in a clean condition and do not permit blasting particles to accumulate and constitute a nuisance or hazard.

E. During abrasive blast cleaning, prevent damage to adjacent coatings. Schedule blast cleaning and coating so that dust, dirt, blast particles, old coatings, rust, mill scale, etc., will not damage or fall upon wet or newly coated surfaces.

3.04 PREPARATION OF CONCRETE AND MASONRY SURFACES TO BE COATED

A. Surface preparation of concrete and masonry surfaces shall be in accordance with SSPC SP-13/NACE No. 6 and the following.

B. Do not apply coating until concrete has cured for at least 30 days at 750F and a minimum 50%. Do not use curing compound on surfaces that are to be coated.

C. Concrete and masonry surfaces on which coatings are to be applied shall be of even color, gray or gray-white. The surface shall have no pits, pockets, holes, or sharp changes of surface elevation. Scrubbing with a stiff-bristle fiber brush shall produce no dusting or dislodging of cement or sand. Sprinkling water on the surface shall produce no water beads or standing droplets. Concrete and masonry shall be free of laitance and slick surfaces.

D. Detergent clean the concrete or masonry surface with Trisodium Phosphate in accordance with ASTM D4258. Then abrade or blast surfaces to the required surface profile. Floor slabs may be acid etched as specified in ASTM D4260 in lieu of sandblasting. After sandblasting, wash surfaces with water to remove dust and salts in accordance with ASTM D4258 or ASTM D4261. Use ICRI standards for concrete and masonry surface preparation.

E. All concrete which has been subjected to low-pH or acidic conditions must be confirmed to have a pH of 9 or greater prior to application of coatings. If the desired surface profile has been achieved without a minimum pH of 9, that surface shall be considered contaminated and in need of further abrasion or blasting.

F. Before coating concrete, plaster, and masonry that is below-grade, on-grade, or new, determine the presence of capillary moisture in accordance with ASTM D4263, except as modified below. Tape a 4-foot-by-4-foot sheet of polyethylene plastic to the concrete surface to be coated. Allow the plastic sheet to remain in place at least 24 hours. After the specified time has elapsed, remove the plastic sheet and visually examine both the underside of the plastic sheet and

the concrete surface beneath it. There shall be no indication of moisture on either surface. If moisture is indicated, allow additional curing time for the concrete and then retest. Provide one test sheet for every 500 square feet of concrete surface to be coated. For walls, provide one test sheet for each 10 feet (or fraction thereof) of vertical rise in all elevations starting within 12 inches of the floor or base slab.

G. Acceptance criteria for concrete surfaces shall be in accordance with SSPC SP-13, Table 1, "Severe Service" or this Section, whichever is more stringent.

H. Do not apply coatings to concrete when the concrete is outgassing. Apply coatings only when the concrete surface temperature is stable or declining, not rising. Apply concrete coatings when the temperature is falling to reduce the potential of outgassing.

3.05 COATING STAINLESS STEEL, NONFERROUS, AND COPPER

A. Solvent clean in accordance with SSPC SP-1. Solvents and cleaning solutions shall contain less than 200 mg/L of halogens. Then prepare in accordance with the specified coating system.

B. All surfaces must be primed as soon as possible on the same day following surface preparation.

3.06 PROCEDURES FOR ITEMS HAVING SHOP-APPLIED PRIME COATS

A. After applying primer to surfaces, allow coating to cure for a minimum of 2 hours before handling to minimize damage.

B. When loading for shipment to the project site, use spacers and other protective devices to separate items to prevent damaging the shop-primed surfaces during transit and unloading. If wood spacers are used, remove wood splinters and particles from the shop-primed surfaces after separation. Use padded chains or ribbon binders to secure the loaded items and minimize damage to the shop-primed surfaces.

C. Cover shop-primed items 100% with protective coverings or tarpaulins to prevent deposition of road salts, fuel residue, and other contaminants in transit.

D. Handle shop-primed items with care during unloading, installation, and erection operations to minimize damage. Do not place or store shop-primed items on the ground or on top of other work unless the ground or work is covered with a protective covering or tarpaulin. Place shop-primed items above the ground upon platforms, skids, or other supports.

3.07 FIELD TOUCH-UP OF SHOP-APPLIED PRIME COATS

A. Remove oil and grease surface contaminants on metal surfaces in accordance with SSPC SP-1. Use clean rags wetted with a degreasing solution, rinse with clean water, and wipe dry.

B. Remove dust, dirt, salts, moisture, chalking primers, or other surface contaminants that will affect the adhesion or durability of the coating system. Use a high-pressure water blaster or scrub surfaces with a broom or brush wetted with a solution of Trisodium Phosphate, detergent, and water. Rinse scrubbed surfaces with clean water.

C. Before applying intermediate or finish coats to inorganic zinc primers, remove any soluble zinc salts that have formed by scrubbing with a stiff bristle brush.

D. Remove loose or peeling primer and other surface contaminants not easily removed by the previous cleaning methods in accordance with SSPC SP-7/ NACE No. 3. Take care that the remaining primers are not damaged by the blast cleaning operation. The remaining primers shall be firmly bonded to the steel surfaces with blast-cleaned edges feathered.

E. Remove rust, scaling, or primer damaged by welding or during shipment, storage, and erection in accordance with SSPC SP-10/NACE No. 2. Take care that the remaining primers are not damaged by the blast cleaning operation. Areas smaller than 1 square inch may be prepared in accordance with SSPC SP-11. The remaining primers shall be firmly bonded to the steel surfaces with cleaned edges feathered.

F. Use repair procedures on damaged primer that protect adjacent primer. Blast cleaning may require the use of lower air pressure, smaller nozzles and abrasive particle sizes, short blast nozzle distance from surface, shielding, and/or masking.

G. After abrasive blast cleaning of damaged and defective areas, remove dust, blast particles, and other debris by dusting, sweeping, and vacuuming; then apply the specified touch-up coating.

H. Other surfaces that are shop primed shall receive a field touch-up of the same primer used in the original prime coat.

3.08 PAINTING SYSTEMS

A. All materials of a specified painting system, including primer, intermediate, and finish coats, shall be produced by the same manufacturer. Thinners, cleaners,

driers, and other additives shall be as recommended by the paint manufacturer for the particular coating system.

B. Deliver paints to the jobsite in the original, unopened containers.

3.09 PAINT STORAGE AND MIXING

A. Store and mix materials only in areas designated for that purpose by the Owner's Representative. The area shall be well ventilated, with precautionary measures taken to prevent fire hazards. Post "No Smoking" signs. Storage and mixing areas shall be clean and free of rags, waste, and scrapings. Tightly close containers after each use.

B. Store paint in accordance with the manufacturer's latest written recommendations, or at an ambient temperature from 50°F to 100°F, whichever is more stringent.

C. Prepare multiple-component coatings using all of the contents of the container for each component as packaged by the paint manufacturer. Do not use partial batches. Do not use multiple-component coatings that have been mixed beyond their pot life. Provide small quantity kits for touch-up painting and for painting other small areas. Mix only the components specified and furnished by the paint manufacturer. Do not intermix additional components for reasons of color or otherwise, even within the same generic type of coating.

3.10 PROCEDURES FOR THE APPLICATION OF COATINGS

A. Conform to the requirements of SSPC PA-1. Follow the recommendations of the coating manufacturer, including the selection of spray equipment, brushes, rollers, cleaners, thinners, mixing, drying time, temperature and humidity of application, and safety precautions.

B. Stir, strain, and keep coating materials at a uniform consistency during application. Power mix components. For multiple component materials, premix each component before combining. Apply each coating evenly, free of brush marks, sags, runs, and other evidence of poor workmanship. Use a different shade or tint on succeeding coating applications to indicate coverage where possible. Finished surfaces shall be free from defects or blemishes.

C. Do not use thinners unless recommended by the coating manufacturer. If thinning is allowed, do not exceed the maximum allowable amount of thinner per gallon of coating material. Stir coating materials at all times when adding thinner. Do not flood the coating material surface with thinner before mixing. Do not reduce coating materials more than is absolutely necessary to obtain the proper application characteristics and to obtain the specified dry-film thicknesses.

D. Remove dust, blast particles, and other debris from blast cleaned surfaces by dusting, sweeping, and vacuuming. Allow ventilator fans to clean airborne dust to provide good visibility in working area before applying coating. Remove dust from coated surfaces by dusting, sweeping, and vacuuming before applying succeeding coats.

E. Apply coating systems to the specified minimum dry-film thicknesses as determined in accordance with SSPC PA-2.

F. Apply primer immediately after blast cleaning and before any surface rusting occurs, or any dust, dirt, or any foreign matter has accumulated. Before applying coating, re-clean surfaces that have surface colored or become moist by blast cleaning.

G. Apply a brush coat of the specified primer on welds, sharp edges, nuts, bolts, and irregular surfaces before applying the prime coat. Apply the brush coat before and in conjunction with the spray coat application. Apply the spray coat over the brush coat.

H. Before applying subsequent coats, allow the primer and intermediate coats to dry for the minimum curing time recommended by the manufacturer. In no case shall the time between coats exceed the manufacturer's recommendation.

I. Each coat shall cover the surface of the preceding coat completely and there shall be a visually perceptible difference in applied shade or tint of colors.

J. Applied coating systems shall be cured at 75°F or higher for 48 hours. If temperature is lower than 75°F, curing time shall be in accordance with printed recommendations of the manufacturer, unless otherwise allowed by the Owner's Representative.

K. Assembled parts shall be disassembled sufficiently before painting or coating to ensure complete coverage by the required coating.

3.11 SURFACES NOT TO BE COATED

A. Do not paint the surfaces listed below unless otherwise noted in the drawings or in other Specification sections. Protect the following surfaces during the painting of adjacent areas:

1. Concrete walkways.
2. Mortar-coated pipe and fittings.
3. Stainless steel.

4. Metal letters.
5. Glass.
6. Roofing.
7. Fencing.
8. Electrical fixtures except for factory coatings.
9. Nameplates.
10. Grease fittings.
11. Brass and copper.
12. Buried pipe, unless specifically required in the piping specifications.
13. Fiberglass items, unless specifically required in the FRP specifications.
14. Aluminum handrail, stairs, and grating.

3.12 PROTECTION OF SURFACES NOT TO BE PAINTED

A. Remove, mask, or otherwise protect hardware, lighting fixtures, switch plates, aluminum surfaces, machined surfaces, couplings, shafts, bearings, nameplates on machinery, and other surfaces not intended to be painted. Provide drop cloths to prevent paint materials from falling on or marring adjacent surfaces. Protect working parts of mechanical and electrical equipment from damage during surface preparation and painting process. Mask openings in motors to prevent paint and other materials from entering the motors.

3.13 SURFACES TO BE COATED

A. The exact coating to be applied in any location is not designated by the descriptive phrases in the coating system titles such as “corrosive environment,” “buried metal,” or “submerged metal.” Coat surfaces with the specific coating systems as described below:

1. Coat mechanical equipment such as pumps, blowers, and clarifier mechanisms as described in the various mechanical equipment sections. The color of the finish coat shall be coordinated with the Owner.

2. Coat submerged steel piping and ductile iron piping as specified in System No. 2.

3. Coat valves as described the same as the adjacent piping. Aboveground valves, or valves in vaults and structures, shall match the color of the connecting piping. If the adjacent piping is not coated, coat valves as specified in System No. 21. Coat handwheels the same as the valves.

4. Coat floor stands as specified in System No. 21.

5. Coat concrete and masonry surfaces where shown in the Drawings and as described in this Section. Apply System No. 42 on exposed exterior concrete, System No. 32 on exposed interior concrete surfaces, and System No. 32 on submerged concrete surfaces unless otherwise shown in the Drawings.

6. Coat aluminum surfaces in contact with concrete as specified in System No. 62.

7. Coat buried flanges, nuts and bolts, washers, rods, harnesses, clamps, sleeves, valves, flexible pipe couplings, exposed rebar in thrust blocks, and valve boxes as specified in System No. 21. Coat buried bolt threads, tie bolt threads, and nuts as specified in System No. 21. Coat buried cast iron pieces as specified in System No. 21.

8. Coat aboveground structural steel or structural steel located in vaults and structures as specified in System No. 21. Color of finish coat shall be coordinated with the Owner via submittal.

9. Coat flashing and sheet metal in accordance with System No. 62. Color of finish coat shall be coordinated with the Owner via submittal.

10. Coating Schedule:

Surface or Item	**Coating System No.**
Exposed ferrous piping	21
Submerged ferrous piping	21
Exposed ferrous valves	21
Buried valves	21
Submerged valves	21
Exposed interior concrete surfaces	32
Exposed exterior concrete surfaces	42
Submerged concrete surfaces	32
Interior masonry surfaces	32
Exterior masonry surfaces	42
Aboveground structural steel	21

3.14 DRY-FILM THICKNESS TESTING

A. Measure coating thickness specified for carbon steel surfaces with a magnetic-type dry-film thickness gauge in accordance with SSPC PA-2. Measure coating thickness specified for stainless steel, aluminum, and copper surfaces with an eddy-current type thickness gauge in accordance with ASTM D7091. Provide certification that the gauge has been calibrated by a certified laboratory within the past 6 months. Provide dry-film thickness gauge as manufactured by Mikrotest or Elcometer.

B. Test the finish coat of metal surfaces (except zinc primer and galvanizing) for holidays and discontinuities with an electrical holiday detector. Provide measuring equipment. Provide certification that the gauge has been calibrated by a certified laboratory within the past 6 months. Provide detector as manufactured by Tinker and Rasor, K-D Bird Dog, or similar. Test using voltages recommended by the coating manufacturer.

C. If the Owner's representative suspects low film thickness, the coating thickness for concrete or masonry surfaces may be measured in accordance with ASTM D4138 (tooke gauge). Use of a "tooke" gauge is classified as a destructive test. Before performing any destructive tests on a newly applied coating system, the Owner and Contractor shall determine which of them is responsible for the cost of repairing the damaged coatings.

D. For severe environments, test the finish coat of concrete and masonry surfaces in accordance with NACE SP0188 or ASTM D4787. Patch coatings at the points of thickness measurement or holiday detection.

E. Check each coat for the correct dry-film thickness. Do not measure within 8 hours after application of the coating.

F. For metal surfaces, make five separate spot measurements (average of three readings) spaced evenly over each 100 square feet of area (or fraction thereof) to be measured. Make three readings for each spot measurement of either the substrate or the paint. Move the probe or detector a distance of 1 to 3 inches for each new gauge reading. Discard any unusually high or low reading that cannot be repeated consistently. Take the average (mean) of the three readings as the spot measurement. The average of five spot measurements for each such 100-square-foot area shall not be less than the specified thickness. No single spot measurement in any 100-square-foot area shall be less than 80% nor more than 120% of the specified thickness. One of three readings which are averaged to produce each spot measurement may underrun by a greater amount as defined by SSPC PA-2.

G. Perform tests in the presence of the Owner's Representative.

3.15 REPAIR OF IMPROPERLY COATED SURFACES

A. If the item has an improper finish color or insufficient film thickness, clean and topcoat the surface with the specified paint material to obtain the specified color and coverage. Sandblast or power-sand visible areas of chipped, peeled, or abraded paint, feathering the edges. Then prime and finish the coat in accordance with the Specifications. The work shall be free of runs, bridges, shiners, laps, or other imperfections.

3.16 CLEANING

A. During the work, remove discarded materials, rubbish, cans, and rags at the end of each day's work.

B. Thoroughly clean brushes and other application equipment at the end of each period of use and when changing to another paint or color.

C. Upon completion of painting work, remove masking tape, tarps, and other protective materials, using care not to damage finished surfaces.

END OF SECTION

DIVISION 11

EQUIPMENT

SECTION 11000
GENERAL EQUIPMENT REQUIREMENTS

PART 1 GENERAL

1.01 SCOPE OF WORK

A. This Section specifies general work requirements regarding the products and execution services that are specified in the Division 11 Sections incorporated in the Contract Documents. The requirements specified shall apply to all of the Division 11 Sections, unless noted otherwise.

1.02 SUBMITTALS

The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance:

A. The submittal contents for equipment, instrumentation, controls, and appurtenances specified in the Division 11 Sections shall contain the general information listed below. Additional submittal requirements are contained in the Division 11 Sections.

1. A list and description of all deviations from the Contract Documents.
2. A list of equipment and components on each drawing with each product identified by legend reference. Include product name, manufacturer, and model number.
3. Completely dimensioned plans, elevations, and cross-sections of system equipment and sub-assemblies.
4. Shop and erection drawings showing details, anchor bolt locations, and field connections.
5. Manufacturers' equipment installation instructions.
6. Descriptive literature, technical bulletins, and catalog data sheets for all equipment and purchased sub-components.
7. Installation, operation, maintenance and start-up procedures.
8. Total equipment weight (while operating).
9. Drive mechanism torque rating and bearing life rating.
10. Motor data and catalog information.
11. Submit complete electrical drawings, schematics, and interconnecting wiring diagrams and schedules for the equipment control system, instrumentation, and control panel(s) showing numbered wiring terminals in the control panel conforming to NEMA ICS-1-101. Identify field device terminals, wire number, wire sizes, control and power wire types, and interfaced elements.

12. Control panel construction and panel layout drawings.
13. Complete technical literature for all factory-applied paint systems. Clearly indicate the components to be coated and the corresponding paint system.
14. Manufacturers' descriptive literature, product specifications, and published details.

1.03 QUALITY ASSURANCE

A. Requirements of Regulatory Agencies: The Contractor shall comply with construction requirements of State, County, and other local political subdivision specifications as may exceed the requirements of the codes, standards, and approving bodies referenced in this Section.

1. NFPA Standards: The Contractor shall comply with requirements of the National Fire Protection Association (NFPA) Standards referenced in the various Specifications Sections and as directly appropriate to the work and workmanship.
2. Electrical Requirements: The Contractor shall comply with requirements for both the Underwriters' Laboratories, Inc. (UL) Listings, Labels, and Approvals and the NEMA Stamps or Seals as applicable to electrical equipment or apparatus forming parts of the Mechanical Equipment.

B. Certificates and Permits: Upon completion of work and before final payment, the Contractor shall furnish to the Engineer formal certification of final inspections from authorities having jurisdiction over the work in this project and secure required permits, if any, from such authorities. Additionally, the Contractor shall prepare any detailed diagrams and drawings that are required by those authorities having jurisdiction over the work of this project at no additional cost to the Owner.

C. Source Quality Control: Products used throughout these Specifications and as indicated on the Drawings shall be from companies having established reputations in the manufacture of the particular materials, equipment, or apparatus specified. Such products may be of their own make or products of others for which they assume full responsibility when used in finished products which are not manufactured completely by them and with replacement parts available.

D. Products: The equipment specified in the Division 11 Sections was based on the latest models that were available from the specified equipment manufacturers at the time the Contract Documents were developed. If any equipment models specified in the Division 11 Sections have been discontinued or will be discontinued within 1 year after the bid date, the Contractor shall furnish and install the latest and most recent equipment model at no additional cost to the Owner.

E. For each category of materials and equipment (Products) specified in the Division 11 Sections, the Contractor shall provide Products of the same manufacturer and type.

F. Equipment Selection: The Contractor may furnish equipment of higher electrical characteristics, physical dimensions, capacities, and ratings provided such proposed equipment is approved by the Engineer in writing. Upon receiving the Engineer's approval to provide such equipment, the Contractor shall furnish the connecting mechanical and electrical services including but not limited to circuit breakers, conduit, increased control panel enclosure size, motors, bases, and any other electrical equipment needed to accommodate the higher electrical characteristics at no additional cost to the Owner.

G. If minimum energy ratings or efficiencies of equipment are specified in Division 11, Equipment, the Contractor shall furnish and install equipment that meets or exceeds the specified design and commissioning requirements (no exceptions) as determined by the Engineer.

H. All the equipment specified in the Contract Documents shall be standard units of proven ability as manufactured by a competent organization that is fully experienced, reputable and qualified in the manufacture of the equipment to be furnished. The equipment shall be designed, constructed, and installed in accordance with the best practice and methods and shall operate satisfactorily when installed.

1.04 QUALIFICATIONS

A. The manufacturer of each piece of equipment described in the Division 11 Sections shall meet the following requirements, unless noted otherwise:

1. Have a record of operation, manufacturing and servicing the items specified in the Division 11 Sections for a minimum of 10 years before the Bid Date.
2. Have a minimum of five installations of equipment similar to that specified in this Section at municipal wastewater treatment facilities in Florida before the bid date.
3. Have been in business for at least the 10 consecutive years before the Bid Date.

B. If the equipment manufacturer that the Contractor proposes to furnish and install the equipment described in the Division 11 Sections does not meet these qualifications and is not specified in the Contract Documents, the Engineer reserves the right to reject the equipment from this manufacturer for use on this

project. Any costs incurred by the Contractor as a result of providing equipment from a manufacturer that does not meet the qualifications described in this Section shall not be incurred by the Owner.

C. The Contractor shall furnish documentation that the manufacturer meets these qualifications as part of the submittals specified in Section 01330, Submittals and Acceptance.

1.05 MAINTENANCE

A. Spare Parts

1. The Contractor shall furnish the spare parts specified in the Division 11 Sections. The Contractor shall also submit a list of recommended spare parts, special tools, and lubricants for each equipment item. The list shall include contact information for local sources for supply of all parts and professional service.

1.06 OPERATION AND MAINTENANCE (O&M) MANUALS

A. Operations and Maintenance Manuals shall be in accordance with General Conditions, Supplementary Conditions, and Specification Section 01830, Operations and Maintenance Manuals.

PART 2 PRODUCTS

2.01 MOTORS

A. All motors identified in Division 11 Sections shall be furnished and installed under Division 11, Equipment, and in accordance with Division 16, Electrical.

2.02 CONTROLS

A. General

1. All control panels specified in the Division 11 Sections shall be furnished and installed under Division 11, Equipment, and in accordance with Division 16, Electrical.

2. The Contractor shall furnish and install controls designed to operate on 120-volt, single-phase, 60 Hertz electric service unless otherwise specified. The Contractor shall furnish and install 120-volt step-down voltage transformers as specified in Division 16, Electrical, in each control panel as required.

3. The Contractor shall furnish and install elapsed time meters in each control panel for each piece of motor-driven equipment being controlled by that control panel. All elapsed-time meters shall be furnished and installed in accordance with Division 16, Electrical.

4. All control panels shall be furnished with a main circuit breaker to enable/disable electric service to the panelboard.

5. All control panels that will annunciate a local and/or remote alarm shall be furnished with an ALARM ACKNOWLEDGE reset pushbutton switch (momentary contact) wired to each alarm contact.

6. All indicating lamps in each control panel shall be furnished in accordance with the color-coded scheme:

   a. ON indicating lamps: Green.
   b. OFF indicating lamps: Red.
   c. Alarm indicating lamps: Amber.
   d. POWER ON indicating lamp: White.

7. Provide a heater inside of each control panel enclosure to prevent condensation. Heater size shall be in accordance with the equipment manufacturer's recommendations.

8. The face of each control panel shall be installed so it is facing north whenever possible, or provided with a sunshield when not possible.

2.03 EQUIPMENT ANCHORING SYSTEMS

A. All anchoring systems including, but not limited to, expansion anchors, adhesive anchors, anchor bolts, cinch anchors, and screws that are required to install the equipment and appurtenances specified in the Division 11 Sections shall be AISI Type 316 stainless steel unless noted otherwise.

2.04 EQUIPMENT NAMEPLATES

A. The Contractor shall provide engraved laminated phenolic nameplates with white legend and black field that provides the following information for each piece of equipment described in the Division 11 Sections.

1. Equipment Description (i.e., Screw Pump No. 1, Screw Pump No. 2, and Screw Pump No. 3).
2. Equipment Identification Label No.

B. Letter height on each nameplate shall not be less than 3/4-inch. Nameplates shall be factory drilled for fasteners. Secure nameplates to equipment or nearby wall using AISI Type 304 stainless steel fasteners. The locations of each nameplate shall be coordinated with the Owner and approved by the Owner before their installation.

C. The Contractor shall obtain the Engineer's approval for the nameplate information for each equipment item described in the Division 11 Sections before ordering these nameplates from the manufacturer.

PART 3 EXECUTION

3.01 INSTALLATION

A. General: The Contractor shall install the equipment in accordance with the manufacturer's instructions and recommendations and approved submittals at the locations shown on the Drawings. If the equipment locations shown on the Drawings are in conflict with the manufacturer's recommendations or will interfere with the installation or operation of any other item indicated in the Contract Documents, the Contractor shall relocate this equipment and provide the necessary appurtenances to install the equipment in accordance with the manufacturer's recommendations at no additional cost to the Owner. The Contractor shall not install any equipment at locations not in accordance with the Contract Documents or approved submittals.

B. The Contractor shall install equipment, slabs, walls level and plumb, parallel and perpendicular to other building and components in exposed interior spaces, unless otherwise shown on the Drawings.

C. The Contractor shall apply an anti-seize compound to threaded fasteners of equipment components that require removal, replacement, or adjustment as part of any maintenance or inspection procedure.

D. The Contractor shall furnish and install the required oil and grease for initial operation in accordance with the manufacturer's recommendations.

E. Provide means of oil lubrication for bearings and other metallic parts in sliding contact. Use alemite industrial-type fittings except where otherwise specified. The Contractor shall also perform the following work:

1. Locate lubrication points on equipment readily accessible without the necessity of removing covers, plates, housings or guards, or without creating safety hazards at installed equipment elevations.

2. The Contractor shall exhaust pressure-lubricated units to the atmosphere to prevent excessive greasing.
3. The Contractor shall extend grease fittings to locations that are readily accessible to the Owner. The Contractor shall coordinate the location of these grease fittings with the Owner before their installation.

F. The Contractor shall furnish and apply touch-up paint to any equipment's factory painting finish that is chipped or damaged during installation. All factory-finish touch-up paint shall be mutually compatible with the factory finish on the equipment and shall be furnished by the manufacturer of the equipment to be touched up in the field.

G. If equipment mounting heights are not shown on the Drawings, the Contractor shall install that piece of equipment to provide the maximum amount of headroom (defined as the distance from the bottom of the structure to the top of finished floor or grade), as possible. In such an instance, the Contractor shall obtain the Engineer's approval for this mounting location before installing that piece of equipment in the field.

H. The Contractor shall furnish and install all mechanical equipment to facilitate service, maintenance, and repair or replacement of the equipment components. The Contractor shall connect equipment for ease of disconnecting, with minimum interference to other installations.

3.02 FIELD TESTING

A. General: The Contractor shall provide services of a factory-authorized service representative to perform, approve, and certify the field testing specified in this Section. Field testing shall generally consist of performing the pre-startup and startup tests as specified in the Division 11 Sections and the final mechanical performance test specified in this Section. The Contract Documents may require the Contractor to perform factory testing on equipment items before the Engineer approves their use for this project. The Contractor shall refer to the Division 11 Sections regarding equipment shop testing requirements.

B. The Contractor shall adhere to the following requirements regarding the field testing to be provided for this project:

1. The service representative shall be employed by the manufacturer of the equipment specified at the time field testing is being performed. The service representative shall be authorized by the factory to perform the field testing specified in Division 11, Equipment. Upon request by the Engineer, the Contractor shall submit a letter from a company officer of

the equipment manufacturer stating that the service representative performing the field testing is authorized by the manufacturer.

2. Before scheduling each field test with the equipment manufacturer, the Contractor shall coordinate with the Owner and Engineer to obtain a list of dates that both parties would be available to attend the testing. The Contractor shall notify the Owner and Engineer of the field testing dates no less than 14 calendar days before the date of the field test.
3. If directed by the Engineer, the Contractor shall perform a second pre-startup and/or startup test, in accordance with the procedures specified in the Division 11 Sections, at no additional cost to the Owner if the original pre-startup and/or startup test did not pass because of any work that was deemed by the Engineer to be non-compliant with the Contract Documents and/or manufacturer's recommendations.
4. The Contractor shall only perform startup testing after the Contractor has reached Substantial Completion for the project as defined in the Agreement and General Conditions.
5. The Contractor shall furnish, install, and remove any temporary piping, valves, appurtenances, and equipment necessary to perform the pre-startup and startup testing to the Engineer's satisfaction.
6. All field testing shall be performed Monday through Friday at the project site, unless otherwise approved by the Owner.
7. The duration that the manufacturer's representative is required to be onsite to perform the pre-startup and startup training is specified in the Division 11 Sections.

C. Operating Costs

1. Costs for Pre-startup and Startup Testing: The Contractor shall include in the Contract Price the following operating costs for satisfactorily completing the Initial Mechanical Performance Tests on equipment being tested:

    a. Lubricating grease.
    b. Lubricating oils.
    c. Such other materials or utilities not specifically identified in this Section, but required to conduct the pre-startup and startup testing.

D. The intent of the field testing for each equipment item specified in the Division 11 Sections is provided in this Section. If the individual equipment field testing procedures specified in the Division 11 Sections are not sufficient to obtain a Manufacturer's Certification or to demonstrate compliance with the Contract

Documents, the Contractor shall perform these additional field test procedures at no additional cost to the Owner.

1. Pre-startup Testing: Upon the Contractor's completion of the installation and adjustment of the equipment; the Contractor, with his own forces and with the manufacturer's representative(s), shall demonstrate to the Engineer's satisfaction that the equipment has been furnished and installed in accordance with the Contract Documents and the manufacturer's recommendations.

    a. The Contractor shall repair any equipment items that do not pass the pre-startup test, as identified by the Engineer and/or manufacturer's representative, to the satisfaction of the Engineer before performing the startup testing for that equipment.

2. Startup Testing: Upon successful completion of the pre-startup testing, the Contractor shall demonstrate that the mechanical performance and controls of each equipment item, when operated in accordance with the design intent indicated by the Contract Documents, are satisfactory to the Owner and Engineer.

    a. Startup testing shall be performed with each equipment item and associated treatment structure simulated under similar operating conditions as the final mechanical performance testing specified in this Section. For equipment that will operate while being submerged as shown on the Drawings, the Contractor shall fill the respective treatment structure to its maximum water surface with reclaimed water for wastewater systems or potable water for water systems and perform startup testing while that equipment is submerged. The Contractor shall not use wastewater to fill any treatment structures for startup testing.
    b. After the startup testing procedures specified in the Division 11 Sections have been completed to the satisfaction of the Engineer, the Contractor shall operate that equipment for one successful continuous 72-hour period without assistance from the Owner as a condition of startup testing. If the equipment needs to be taken out of service for repair during this 72-hour period because it not operating in accordance with the intent of the Contract Documents, this operating period shall cease. A new operating period will not begin until the equipment has been operating in accordance with the Contract Documents and manufacturer's recommendations for at least 72 consecutive hours. The Contractor shall furnish any additional supervision or provisions necessary to verify that each

equipment item was successfully operated during this 72-hour operating period.

c. Upon completion of the startup test, the Contractor shall dewater each treatment and storage structure in accordance with local and State regulations and in a manner that is satisfactory to the Owner and Engineer.

3. Final Mechanical Performance Testing: The Contractor shall perform final mechanical performance testing of the equipment specified in the Division 11 Sections once the following conditions have been satisfied:

   a. The Contractor has successfully completed the pre-startup and startup testing requirements specified in the Division 11 Sections.

   b. The Contractor has performed the training services specified in this Section.

   c. The Contractor has procured all of the required permits for each building and treatment structure within the project site.

   d. The Engineer has received and approved all of the manufacturer's certifications of compliance, warranties, and O&M manuals for all required items as specified in the Contract Documents.

   e. The intent of the final mechanical performance test is for the entire facility to be operated by the Owner for a continuous 30-day period while the facility is receiving and treating raw sewage or raw water. During this 30-day testing period the Contractor shall furnish personnel who shall be on-site as needed and available at all times 24 hours per day during the final mechanical performance test. Personnel shall be competent in the troubleshooting and repair of the equipment and related electrical and mechanical systems specified in the Contract Documents. The Contractor's electricians and mechanical technicians shall be on-site as needed (minimum 8 hours/week) and available 24 hours per day to assist with this testing. If the final mechanical performance testing needs to be stopped and suspended due to equipment not operating in accordance with the design intent of the Contract Documents as determined by the Engineer, the following conditions shall apply:

      (1) The Contractor shall repair and troubleshoot these items immediately at no additional cost to the Owner.
      (2) The 30-day period for the final mechanical performance testing will start over (i.e., be reset to zero hours).

f. Upon restarting the final mechanical performance testing, the Contractor shall furnish the appropriate personnel defined above on-site as needed and available (minimum 8 hours/week) for 24 hours per day during the 30-day period at no additional cost to the Owner even though the total duration of the final mechanical performance testing (including restarts), may exceed 30 days.

g. The final mechanical performance test shall end when the Engineer determines that all of the equipment and related systems are operating in accordance with the design intent of the Contract Documents and all deficiencies that hinder the normal day-to-day operation of the facility have been corrected to the satisfaction of the Engineer. The Engineer shall notify the Contractor in writing when the final mechanical performance testing has been successfully completed.

3.03 TRAINING SERVICES

A. Upon completion of the pre-startup and startup testing and before the final mechanical performance testing, the manufacturer of the equipment specified in the Division 11 and 15 Sections shall provide an authorized representative to train the Owner's personnel in the operation and maintenance of the equipment. The representative shall provide additional onsite startup and troubleshooting services during this training upon request by the Engineer or Owner while performing these training services. The duration of the training services for each equipment item are specified in the Division 11 Sections.

3.04 MANUFACTURER'S CERTIFICATIONS OF COMPLIANCE

A. Upon successful completion of the pre-startup testing, startup testing, and training services specified in this Section, the Contractor shall obtain the equipment manufacturer's certification that the equipment specified in the respective Division 11 Sections has been installed, adjusted, and tested in accordance with the manufacturer's recommendations. The Contractor shall furnish the Engineer with Manufacturer's Certificates of Compliance and Equipment Manufacturer's Certificate of Installation Testing and Instruction for each specified equipment item before performing the final mechanical performance testing specified in this Section.

MANUFACTURER'S CERTIFICATE OF COMPLIANCE

OWNER _____ EQPT SERIAL NO: _____

EQPT TAG NO: _____ EQPT/SYSTEM: _____

PROJECT NO: _____ SPEC. SECTION: _____

I hereby certify that the above-referenced equipment/system has been:

(Check Applicable)

_____ Installed in accordance with Manufacturer's recommendations.

_____ Inspected, checked, and adjusted.

_____ Serviced with proper initial lubricants.

_____ Electrical and mechanical connection meet quality and safety standards.

_____ All applicable safety equipment has been properly installed.

_____ System has been performance tested, and meets or exceeds specified performance requirements (when complete system of one manufacturer).

Comments: _____

_____

_____

_____

I, the undersigned Manufacturer's Representative, hereby certify that I am (i) a duly authorized representative of the manufacturer, (ii) empowered by the manufacturer to inspect, approve, and operate his equipment, and (iii) authorize the make recommendations required to assure that the equipment furnished by the manufacturer is complete and operational, except as may be otherwise indicated herein. I further certify that all information contained herein is true and accurate.

Date: _____, 20___

Manufacturer: _____

By Manufacturer's Authorized Representative: _____
(Authorized Signature)

EQUIPMENT MANUFACTURER'S CERTIFICATE OF INSTALLATION TESTING AND INSTRUCTION

OWNER City of Clearwater

PROJECT East WRF Screw Pump Replacement

CONTRACT NO. 22-0028-UT

Jones Edmunds No. 03720-062-01

EQUIPMENT SPECIFICATION SECTION _____

EQUIPMENT DESCRIPTION _____

I _____, Authorized representative of
(Print Name)

_____
(Print Manufacturer's Name)

hereby CERTIFY that _____
(Print equipment name and model with Serial No.)

Installed for the subject project has have been installed in a satisfactory manner, has have been satisfactorily tested, is/are ready for operation, and that Owner assigned operating personnel have been suitably instructed in the operation, lubrication, and care of the units on Date:

_____ Time: _____.

CERTIFIED BY: _____ DATE: _____
(Signature of Manufacturer's Representative)

OWNER'S ACKNOWLEDGEMENT OF MANUFACTURER'S INSTRUCTION

I/We the undersigned, authorized representatives of the _____ and/or Plant Operating Personnel have received classroom and hands on instruction on the operation, lubrication, and maintenance of the subject equipment and am/are prepared to assume normal operational responsibility for the equipment:

_____ DATE: _____

_____ DATE: _____

_____ DATE: _____

END OF SECTION

SECTION 11282
FABRICATED GATES

PART 1 GENERAL

1.01 SCOPE OF WORK

A. This Section shall only be applicable to the Contract Documents for reference in refurbishing the slide gate components or in the event that the Owner elects the Deductive Bid Alternate for Slide Gate Replacement as defined in Section 01200, Measurement and Payment. The Contractor is responsible for field-verifying all existing gate components, dimensions, and operation to ensure the refurbished or replaced product meets or exceeds the field conditions.

B. Furnish all labor, materials, and incidentals required to provide the fabricated gates specified herein as well as shown on the Drawings. The fabricated gates for this project include, but are not limited to:

1. Aluminum slide gates. The gates and appurtenances shall be supplied in accordance with the latest edition of AWWA C562 as modified herein. The allowable leakage rate for the aluminum gates in this specification shall be in accordance with the allowable leakage listed in the latest revision of AWWA C562.

1.02 SUBMITTALS

A. The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance.

B. Complete description of all materials including the material thickness of all structural components of the frame and slide.

C. Installation drawings showing all details of construction, details required for installation, dimensions, weights, and anchor bolt sizes, hole depths and locations.

D. Maximum bending stress and deflection of the gate and channels under the maximum design head.

1.03 REFERENCE STANDARDS

Reference standards and recommended practices referred to in this Section shall be the latest revision of any such document in effect at the bid time. The following documents are a part of

this Section. Where this Section differs from these documents, the requirements of this Section shall apply.

A. American Iron and Steel Institute (AISI)

1. AISI 410—Stainless Steel.
2. AISI 416—Stainless Steel plus Related Metals.
3. AISI 4142—Heat Treated Steel Specifications.

B. American Society for Testing and Materials (ASTM)

1. ASTM A193/A193M—Standard Specification for Alloy-Steel and Stainless Steel Bolting for High Temperature or High Pressure Service and Other Special Purpose Applications.
2. ASTM A240/A240M—Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.
3. ASTM A276/A276M—Standard Specification for Stainless Steel Bars and Shapes.
4. ASTM A380/A380M—Standard Practice for Cleaning, Descaling, and Passivation of Stainless Steel Parts, Equipment, and Systems.
5. ASTM B209/B209M—Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
6. ASTM B308/B308M—Standard Specification for Aluminum-Alloy 6061-T6 Standard Structural Profiles.
7. ASTM D3935—Standard Classification System and Basis for Specification for Polycarbonate (PC) Unfilled and Reinforced Material.

C. American Society of Mechanical Engineers (ASME)

1. ASME Section IX—Welding and Brazing Qualifications.

D. American Welding Society (AWS)

1. ANSI/AWS D1.1—Structural Welding Code-Steel.

E. American Water Works Association (AWWA)

1. AWWA C562—Fabricated Aluminum Slide Gates.

1.04 QUALITY ASSURANCE

A. The Contractor shall provide quality assurance measures for the items specified in this Section in accordance with Section 11000, General Equipment Requirements.

1.05 WARRANTIES

A. Warranties shall be in accordance with General Conditions, Supplemental General Conditions, and Section 01780, Warranties and Bonds.

1.06 DELIVERY, STORAGE, AND HANDLING

A. The Contractor shall adhere to the requirements specified in Section 01650, Delivery, Storage, and Handling, for storage and protection of the items specified in this Section.

1.07 QUALIFICATIONS

A. The manufacturer(s) of the equipment specified in this Section shall meet the qualifications specified in Section 11000, General Equipment Requirements.

1.08 OPERATIONS & MAINTENANCE (O&M) MANUALS

A. O&M Manuals shall be in accordance with General Conditions, Supplemental General Conditions, and Section 01830, Operations and Maintenance Manuals.

1.09 SPECIAL DESIGN CONSIDERATIONS

A. All of the fabricated gates and appurtenances specified in this Section shall be furnished by a single manufacturer.

B. The Contractor shall be responsible for determining the actual cutout dimensions required for each embedded fabricated gate frame before coordinating any modifications needed to the concrete walls, decks, and slabs around each frame.

C. Fabricated Gate Materials

1. All furnished fabricated gates immersed or directly exposed to wastewater shall be suitable for long-term exposure to wastewater and produced gases and by-products.
2. The gates shall be designed and constructed to operate outdoors in a non-covered or enclosed, corrosive area containing hydrogen sulfide and other compounds commonly found in wastewater treatment facilities.

D. The Anchor bolts shall be provided by the gate manufacturer for mounting the gates and appurtenances. Quantity and location shall be determined by the gate

manufacturer. If epoxy type anchor bolts are provided, the gate manufacturer shall provide the studs and nuts. Anchor bolts shall have a minimum diameter of 1/2 inch.

E. The Contractor shall verify with the fabricated gate manufacturer that all fabricated gates of sufficient width and height function as intended as determined in the field upon Contractor verification.

PART 2 PRODUCTS

2.01 PERFORMANCE AND DESIGN REQUIREMENTS

A. Equipment Identification Labels

1. As determined in the field upon Contractor verification.

B. Performance Requirements: The leakage from slide gates in the fully closed position shall not exceed the following:

1. 0.05 gpm per foot around the wetted gate perimeter when subjected to the design seating head (measured from the gate invert).
2. 0.05 gpm per foot around the wetted gate perimeter when subjected to the design unseating head (measured from the gate invert).

C. General Design Conditions

1. As determined in the field upon Contractor verification.

D. Acceptable Manufacturers

1. Waterman Valve LLC.
2. Engineer-approved equal.

2.02 EQUIPMENT

A. General: The fabricated gates specified in this Section shall be used to isolate or control the rate of flow from one channel or unit process basin to another by lowering or raising a plate from a gate operator located above the operating floor. The slide gates specified in this Section shall be of the upward-opening type that shall close when the plate is lowered into the flow channel or basin.

B. Materials: The specifications herein below shall apply to each fabricated gate specified in this Section.

1. Plate: The gate plate shall consist of a flat plate reinforced with structural or formed members welded to the plate with structural shapes extrusions welded to the plate as required. The extrusions shall be of the same material as the plate. The reinforcing members shall be of the same material as the plate. Each plate shall be a minimum thickness of 1/2-inch where the plate engages the slides and be designed to limit deflection of the plate to 1/720 of its span, or 1/16-inch, whichever is less, when subjected to the design conditions as confirmed in the field. All plate components shall have a minimum material thickness of 1/4 inch. Working stresses shall not exceed 50% of the material's yield strength or 25% of the material's ultimate strength, whichever is less.

2. Frame: The gate frame shall consist of guides, an invert member, and operator yoke welded or bolted together to form a rigid one-piece frame. Each frame shall be furnished with guides that are of "sandwiched" type construction and built-up of plates, angles, and formed shapes in full accordance with the latest AWWA standards. Yoke members to be designed to limit the deflection to 1/360 of its span or 1/8 inch, whichever is less, and shall be arranged to permit removing the plate from the frame.

a. General

(1) Self-contained Frames: The frame assembly for fabricated slide gates furnished with self-contained frames shall extend out of the gate opening, to at least above the full height of the disk in the "open" position. The yoke to support the gate operator operating shall be formed by angles welded at the top of the guides to provide a one-piece rigid frame. The arrangement of the yoke will be such that the plate and stem can be removed without disconnecting the yoke. The yoke members shall be designed for the maximum output of the gate hoist.

(2) Embedded Frames: Each fabricated gate to be mounted within a flow channel (guide slots recessed in the concrete walls on the seating and unseating side of the gate) shall be furnished with an embedded frame assembly suitable for installing the fabricated gate in the flow channel. The invert of embedded unit frames shall have an angle welded to the lower ends of the guides to incorporate a flush bottom seal that is attached to the bottom of the frame invert. Seals

attached to the plate are not acceptable. All seats and seals shall be mechanically fastened and field replaceable.

(3) Wall-Mounted Frame: Each fabricated gate to be wall-mounted shall be furnished with a frame assembly suitable for mounting the fabricated gate to the concrete surfaces at the end of the flow channel or wall opening. All wall-mounted or wall thimble-mounted gates shall have a flange frame. Flat-frame gates are not acceptable.

b. Slide Gates: The frame assembly for slide gates shall be furnished with an invert structural member or formed shape welded to the bottom of the frame to form a flush surface and to meet with the plate seal. A specially molded resilient seal shall be mounted on the bottom of the plate to provide a flush-bottom closure. The shape of the slide mounted seals shall produce a seating surface having a minimum width of 3/4 inch, and the seal will extend into the secondary slot of the guide. The vertical face of the seal shall be in contact with the seating surface of the guide to provide a proper seal at the corners. Alternately, the flush bottom seal can be mounted to the frame invert.

3. Guides: Each side of the gate frame shall be furnished with slotted guide slots that shall overlap both sides of the plate by at least 3/4 inch and allow the plate to travel in the vertical direction.

a. Each fabricated gate shall be furnished with ultra-high molecular weight polymer (UHMWPE) strips securely attached by mechanical fasteners in the guide in the guide to provide a low-friction surface on which the plate will slide. The guide shall be designed for maximum rigidity and shall be provided with keyways to lock it into the concrete. The invert of the frame The invert of the frame on upward opening gates shall be a structural member welded to the lower ends of the guides to form a mounting surface for the flush-bottom resilient seal.

b. For self-contained frames, the guides extending above the operating floor shall be sufficiently strong to be free-standing so that no further reinforcing will be required. Guides shall be sufficiently rigid to handle wind loads when the slide is in its highest travel position. The yoke to support the operating bench stand for standard frames shall be formed by two angles or channels welded at the top of the guides to provide a one-piece rigid frame. The arrangement of the yoke shall be such that the plate and stem can be removed without disconnecting the yoke. The design of the yoke shall be such to limit its deflection to 1/360

of its span or 1/18-inch, whichever is less, under full operating load.

c. The guide shall have weight of not less than 3 pounds per foot and will be provided with holes for anchor bolts at a maximum of 12 inches for wall-mounted frames or embedded keyways for embedded frames.

d. Guides shall extend beneath the channel or basin opening a sufficient amount to support the plate in the fully open position for downward opening gates and shall extend above the channel to support the full height of the plate when the gate is in the fully open position.

4. Stems: Each fabricated gate shall be of the rising-stem type and shall be furnished with a stem extending from the yoke to the top of the gate plate at its lowest operating elevation. Each stem shall be ASTM A276/A276M Type 316/316L stainless steel. Each gate stem shall be designed to withstand twice the force transmitted to the gate plate from an 80-lb pull on the gate operator when subjected to the design head conditions in Gate Schedule on the Drawing and elsewhere in the Drawings. Stems shall be cut-threaded or rolled-threaded with full depth threads and threaded adequately to provide full travel of the gate plate. Stem threads shall be polished to a 16-microinch finish. The stem length/stem radius (L/r) ratio of the unsupported stem segment shall not exceed 200.

5. The threaded portion of the stem shall have a minimum outside diameter of 1-1/2 inches. Stem extension pipes are not acceptable.

6. The stem shall be constructed of solid stainless steel bar for the entire length, the metal having a tensile strength of not less than 75,000 psi.

7. The threaded portion of the stem shall have machine rolled threads of the full Acme type with a 16 microinch finish or better. Stub threads are not acceptable.

8. Stems, on manually operated gates, shall be provided with adjustable stop collars to prevent over closing of the slide.

   a. Stem Guides: Stem guides shall be furnished as needed to limit the unsupported stem length to the specified L/r ratio.

   b. Stem Covers: Each fabricated gate shall be furnished with a stem cover to indicate the gate position (open/closed), permit inspection of the stem threads, and protect the stem from contamination. The stem cover material shall be clear polycarbonate meeting ASTM D3935 standards. Vent holes shall be provided in each stem

cover to prevent condensation and a stem cap shall be provided at the top of the stem cover. Each stem cover shall be furnished with a clear mylar position-indicating marking tape. The marking tape shall be adhesively backed and shall be permanently marked and calibrated in feet and inches.

c. Stem Couplings: Stem couplings, if needed, shall be fabricated from ASTM A276/A276M Type 316/316L stainless steel and shall be threaded and keyed to ensure a true and stable connection.

9. Gate Operators:

a. General: The operators for each gate shall consist of a hoist connected to the stem. Each hoist shall be operated with by handwheel or motorized actuator with manual bypass as noted on the Gate Schedule in the Drawings to raise or lower each fabricated gate as needed.

(1) All gate operators shall be designed for manual operation unless noted otherwise in the Gate Schedule in the Drawings.
(2) All gate operators shall be located at a height of 42 inches above the operating platform elevation, unless noted otherwise in Gate Schedule in the Drawings.
(3) All crank operated hoists shall be geared and shall have a weatherproof cast iron or cast aluminum housing or pedestal with a 2-inch bronze operating nut.
(4) Operators shall be grease lubricated and provided with grease fittings at readily accessible locations.
(5) The bench stand or floor stand hoists for standard frames shall be sized to permit operation of each fabricated gate subjected to the design head condition specified in the Gate Schedule in the Drawings, with a maximum 80-pound pull on the crank or handwheel.
(6) All gates having widths greater than two times their height shall be provided with two lifting devices connected by a tandem shaft for simultaneous operation.
(7) Gearboxes shall have either single or double gear reduction depending upon the lifting capacity required.
(8) Gearboxes shall be provided with a threaded cast bronze lift nut to engage the operating stem.
(9) Bearings shall be provided above and below the flange on the operating nut to support both opening and closing thrusts.

(10) Positive mechanical seals shall be provided on the operating nut and the pinion shafts to exclude moisture and dirt and prevent leakage of lubricant out of the hoist.

(11) The crank shall be removable.

b. Hoist: Each hoist shall be furnished with thrust bearings, bronze hoist nuts and an internally threaded bronze stop nut to limit the downward travel of the stem and slide. All hoist nuts shall be manganese bronze conforming to ASTM B584 C86500. The hoist nut shall be supported on roller bearings. A lubrication fitting shall be provided for lubrication of hoist bearings without disassembly of the hoist. Suitable seals shall be provided to prevent entry of foreign matter. The direction of handwheel or crank rotation to open the gate shall be clearly and permanently marked on the hoist.

c. Remote Drive Assembly: Each fabricated gate that has a normal yoke elevation higher than 42 inches above the top of the operating platform elevation shall be furnished with a remote drive assembly mounted to the frame as specified on the Gate Schedule in the Drawings. The remote drive assembly shall consist of a geared lift coupled to a 90-degree bevel gear box by means of a floating shaft and lovejoy couplings. This gear box shall be mounted on the edge of the self-contained yoke. A second gear box shall be placed 42 inches above the structure and connected by means of a shaft and couplings. All shafts and couplings shall be AISI Type 316 stainless steel and aligned to acceptable coupling tolerance. The cast iron or cast aluminum gear box. Cast iron housing shall be epoxy coated in accordance with Section 09900, Painting and Coating.

d. Chain wheels are not acceptable.

e. Cranks: Crank operators where specified shall be self-locking at any position of stem travel. Cranks shall be cast aluminum or Type 316/316L stainless steel. Cranks shall be no less than 12 inches long and shall be keyed to the operating nut.

10. Seals: Provide seals with a self-adjusting seal system to restrict leakage in the guides of each frame to allow each fabricated gate to meet the performance requirements specified in this Section when subjected to the design head conditions in the Gate Schedule on the Drawings.

a. All gates shall be equipped with UHMW polyethylene seat/seals to restrict leakage and to prevent metal to metal contact between the

frame and slide. Gates that utilize rubber "J" seals or "P" seals are not acceptable. The seal system shall be durable and shall be designed to accommodate high velocities and frequent cycling without loosening or suffering damage. All seals must be bolted or otherwise mechanically fastened to the frame or slide. Arrangement with seals that are force fit or held in place with adhesives are unacceptable.

b. The seal system shall have been factory tested to confirm negligible wear (less than 0.01 inch) and proper sealing. The factory testing shall consist of an accelerated wear test comprised of a minimum of 25,000 open-close cycles using a well-agitated sand/water mixture to simulate fluidized grit.

c. Bottom Seals: Each fabricated gate shall be furnished with an extruded resilient neoprene seal mounted on the bottom of the plate or into the invert member to provide flush-bottom closure. For slide mounted seals, the shape of the seal shall produce a seating surface with a minimum width of 3/4 inch. The seal shall be designed to extend into the secondary slot of the guide and the vertical face of the seal shall contact the seating surface of the guide to provide a proper seal at the corners.

C. Aluminum Fabricated Gates

1. General: The specifications herein below shall apply to the aluminum fabricated gate components specified in this Section.

2. Materials: Each aluminum fabricated gate shall be fabricated from the following materials:

   a. Plate: The plate shall be Aluminum ASTM B209/B209M 6061-T6. Plate stiffeners shall be Aluminum ASTM B308/B308M 6061-T6.
   b. Frame, Guides and Yoke: Aluminum ASTM B308/B308M 6061-T6.
   c. Thrust Nut: Aluminum B26-356.

3. Stem Guides: Stem guides, where required to limit the unsupported stem length, shall be cast or fabricated aluminum with polymer bushings. The stem shall be constructed of two angles or plates. The stem connector shall be welded to the slide. A minimum of two bolts shall connect the stem to the stem connector.

2.03 EQUIPMENT LABELS

A. General

1. Furnish a 1-1/2-inch-minimum-diameter stainless-steel tag for each fabricated gate. Use block-type numbers and letters with 1/4-inch-minimum high numbers and letters stamped on and filled with black enamel. Each tag shall bear the equipment identification label shown in the Gate Schedule on the Drawings.
2. Attach the tag to the operator by soldered split key rings so that the ring and tag cannot be removed. Alternately, permanently fasten the tag to the gate with rivets or stainless steel screws. No adhesives shall be permitted.

PART 3 EXECUTION

3.01 INSTALLATION

A. All fabricated gates shall be thoroughly cleaned and installed in strict conformance with the manufacturer's recommendations prior to installation. Stem threads shall be cleaned and coated with an anti-galling compound prior to installation.

B. The Contractor shall install the equipment specified herein in accordance with Section 11000, General Equipment Requirements.

C. Fabricated gate components shall be machined and/or adjusted as needed to meet the design tolerances specified in this Section and recommended by the manufacturer.

D. Install the equipment in the locations as shown on the Drawings and in accordance with manufacturer's instructions and recommendations and the approved shop drawings.

E. The Contractor shall apply a polyurethane sealant, resilient gasket or non-shrink grout between the frame and wall surfaces as needed to produce a watertight seal. The sealant type shall be as recommended by the fabricated gate manufacturer and shall be suitable for submerged applications.

F. The Contractor shall have weir invert elevations set by a professional licensed surveyor at weir invert setpoint elevations shown on the Drawings at startup. Contractor shall mark stem covers with the invert setpoint elevations.

3.02 PAINTING AND SURFACE PREPARATION

A. The Contractor shall paint all of the cast iron and carbon steel fabricated gate components specified in this Section in accordance with Section 09900, Painting and Coating.

B. The gate manufacturer shall passivate all welds on stainless steel in accordance with ASTM A380/A380M.

3.03 FIELD TESTING

A. The Contractor shall provide the services of a factory authorized service representative to perform, approve, and certify the pre-startup testing and startup testing specified herein. The service representative shall be certified and employed by the manufacturer of the equipment specified herein. All field testing shall be provided in accordance with Section 11000, General Equipment Requirements.

1. The factory authorized service representative shall be onsite to perform the testing services specified herein in accordance with Table 11000-1 of Section 11000, General Equipment Requirements.

2. Pre-Startup Testing: The factory authorized service representative shall inspect each fabricated gate and verify that the components have been furnished and installed in accordance with the Contract Documents and manufacturer's recommendations.

3. Startup Testing: The factory authorized service representative shall be onsite a to perform the startup testing specified below in accordance with Table 11000-1 of Section 11000, General Equipment Requirements:

    a. With each basin or flow channel completely dewatered, the gate plate for each fabricated gate shall be fully raised and lowered along its guide system a minimum of three times to ensure that it operates freely and that the required clearance between the plate and gate guide groove are maintained at all times. During the startup testing, the geared hoists shall be adjusted as needed so that the maximum pull needed to raise and lower the plate does not exceed the value specified in this Section.

4. Final Mechanical Performance Testing: The Contractor shall perform final mechanical performance testing for this equipment in accordance with Section 11000, General Equipment Requirements.

   a. With each basin or flow channel is submerged, each fabricated gate shall be operated so that is fully closed (slide gates). When the downstream flow channel or basin has been isolated and dewatered below the gate plate invert, the Contractor shall measure the average leakage rate from each fabricated gate over a period of 30 minutes. If the leakage rate exceeds the design requirements specified herein, the Contractor shall adjust the gate components in the field as needed. If the leakage rate still exceeds the design requirements specified in this Section after the field adjustments have been performed, the Contractor shall furnish a factory authorized service representative onsite to inspect, repair, and adjust the fabricated gates as needed. These service representative services shall be furnished to the Owner at no additional cost.

3.04 TRAINING SERVICES

A. The factory authorized service representative shall be onsite to perform training services during the field testing services specified herein. Training services shall be in accordance with Section 11000, General Equipment Requirements.

3.05 MANUFACTURER'S CERTIFICATION OF COMPLIANCE

A. The Contractor shall furnish a Manufacturer's Certification of Compliance for the equipment specified herein in accordance with Section 11000, General Equipment Requirements.

END OF SECTION

SECTION 11310
OPEN SCREW PUMP EQUIPMENT

PART 1 GENERAL

1.01 SCOPE OF WORK

A. The Contractor shall furnish all labor, materials, equipment, and incidentals required and install, place in operation, and field-test open screw pumps, motors, and control systems as specified in these Specifications.

B. These Specifications are intended to give a general description of what is required but do not cover all details, which will vary with the requirements of the equipment application. The Specifications are, however, intended to cover the furnishing, shop testing, delivery, complete installation, and field-testing of all materials, equipment, and appurtenances for the complete pumping systems as specified in this Section, whether specifically mentioned in these Specifications or not.

1.02 SUBMITTALS

A. The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance.

B. The Contractor shall submit to the Engineer copies of all materials required to establish compliance with this Section. Submittals shall include at least the following:

1. Certified shop and erection drawings showing all important details of construction, dimensions, and anchor bolt locations. The Contractor shall field-verify all elevations, angles, dimensions, clearances, etc. required by the manufacturer and as necessary to complete the work. These measurements shall be included on the certified shop and erection drawings.
2. Descriptive literature, bulletins, and/or catalogs of the equipment.
3. Data on the characteristics and performance of each pump. Data shall include guaranteed performance curves that show that they meet the specified requirements for capacity based on screw diameter, number of flights, angle of inclination, fill depth, efficiency, and horsepower. Curves shall be submitted electronically. Curves shall be plotted from no flow to the maximum pump capacity. Catalog sheets showing a family of curves shall not be acceptable.

4. Complete master wiring diagrams, elementary or control schematics including coordination with other electrical control devices such as the pump control system, and suitable outline drawings shall be furnished for approval before proceeding with manufacture. Provide suitable outline drawings showing such details as are necessary to facilitate interconnections with other equipment. Standard pre-printed sheets or drawings simply marked to indicate applicability to this Contract shall not be acceptable. Refer to the Electrical Drawings for the control wiring diagrams for the pump motors.
5. A complete total bill of materials of all equipment.
6. A list of the manufacturer's recommended spare parts to be supplied in addition to those specified in Article 1.09, with the manufacturer's current price for each item. Include gaskets, packing, etc. on the list. List bearings by the bearing manufacturer's numbers only.
7. Complete motor and drive data.

C. Test Reports to be Submitted:

1. Description of test procedures and equipment.
2. Copies of all test results, as specified in Parts 2 and 3 of this Section.

D. Complete operating and maintenance instructions shall be furnished for all equipment specified in this Section in accordance with the General Conditions and Division 1, General Requirements.

E. The Contractor shall submit the manufacturer's Certificate of Installation, Testing, and Instruction as specified in Division 1, General Requirements.

F. If it is impossible to conform to certain details of the Specifications due to different manufacturing techniques, describe completely all non-conforming aspects.

1.03 REFERENCE STANDARDS

A. American Bearing Manufacturers Association (AFBMA)

B. American Gear Manufacturers Association (AGMA)

C. American Institute of Steel Construction (AISC)

1. Specification for the Design, Fabrication and Erection of Structural Steel for Buildings

D. American Society of Testing and Materials (ASTM)

1. ASTM A36/A36M—Standard Specification for Structural Steel.
2. ASTM A276/A276M—Standard Specification for Stainless Steel Bars and Shapes
3. ASTM F3125/F3125M—Standard Specification for High Strength Structural Bolts and Assemblies, Steel and Alloy Steel, Heat Treated, Inch Dimensions 120 ksi and 150 ksi Minimum Tensile Strength, and Metric Dimensions 830 MPa and 1040 MPa Minimum Tensile Strength.

E. American Society of Civil Engineers (ASCE)

F. American Welding Society (AWS)

1. AWS D1.1/D1.1M—Structural Welding Code – Steel.
2. AWS QC1—Specification for AWS Certification of Welding Inspectors.

G. International Electrotechnical Commission (IEC)

H. Institute of Electrical and Electronics Engineers (IEEE)

I. National Electrical Manufacturers Association (NEMA)

J. Steel Structures Painting Council (SSPC)

1.04 QUALITY ASSURANCE

A. Qualifications

1. To ensure unity of responsibility, the pumps, motors, and drives shall be furnished and coordinated by the pump manufacturer. The Contractor shall assume full responsibility for the satisfactory installation and operation of the entire pumping systems including pumps, motors, drives, and controls as specified.
2. The equipment covered by these Specifications shall be standard units of proven ability as manufactured by a competent organization having long experience in the production of such equipment. The pumps furnished shall be designed, constructed, and installed in accordance with the best practice and methods and shall operate satisfactorily when installed.
3. All equipment furnished under this Specification shall be new and unused and shall be the standard product of manufacturers having a successful record of manufacturing and servicing the equipment and systems specified in this Section for a minimum of 5 years.

4. The manufacturer shall be fully responsible for the design, arrangement, and operation of all connected rotating components of the assembled pumping unit to ensure that neither harmful nor damaging vibrations occur at any speed within the specified operating range.

B. Services of Manufacturer's Representative

1. The equipment manufacturer shall furnish the services of a competent and experienced factory representative who has complete knowledge of proper installation, operation, and maintenance of the equipment in accordance with Table 11000-1 of Section 11000, General Equipment Requirements, to inspect the installed equipment, perform an initial test run, conduct final performance testing, and provide operating and maintenance instructions to the plant personnel.

   a. The first visit shall be for checking and inspecting the equipment after it is installed.
   b. The second visit shall be to perform the initial test run, conduct final performance testing, and provide operator training.

2. At least one of the days shall be allocated solely to the instruction of plant personnel in operation and maintenance of the equipment. This instruction period shall be scheduled with the Owner at least 10 days in advance and shall take place before pump station start-up and acceptance by the Owner. The final approved copies of operation and maintenance manuals must have been delivered to the Engineer before the instruction period is scheduled with the Owner.

3. The Contractor shall record, in a digital format, all training provided by the manufacturer's representative. The recording(s) or other electronic media shall become the property of the Owner.

4. If there are difficulties in operating the equipment due to the manufacturer's fabrication or the Contractor’s installation, additional service shall be provided at no change in Contract Price or Time.

1.05 WARRANTIES

A. Warranties shall be in accordance with General Conditions, Supplementary Conditions, and Section 01780, Warranties and Bonds.

B. All equipment supplied under this Section shall be warranted for 1 year by the Contractor and the manufacturer. The Warranty period shall begin as outlined in the General Conditions and Division 1, General Requirements.

C. The equipment shall be warranted to be free from defects in workmanship, design, and materials. If any part of the equipment fails during the warranty period, it shall be replaced and the unit(s) restored to service at no expense to the Owner.

D. The manufacturer's warranty period shall run concurrently with the Contractor's warranty period. No exception to this provision shall be allowed.

E. Refer to the General Conditions and Division 1, General Requirements, for additional warranty requirements.

1.06 DELIVERY, STORAGE, AND HANDLING

A. The Contractor shall adhere to the requirements specified in the Section 01650, Delivery, Storage, and Handling, for storing and protecting the items specified in this Section.

B. All equipment and parts shall be properly protected so that no damage or deterioration will occur during a prolonged delay from the time of shipment until installation is completed and the units and equipment are ready for operation.

C. Factory-assembled parts and components shall not be dismantled for shipment unless permission is received in writing from the Engineer.

D. Finished surfaces of all exposed surfaces shall be protected by wooden blanks, strongly built and securely bolted.

E. Finished iron or steel surfaces not painted shall be properly protected to prevent rust and corrosion.

F. Each box or package shall be properly marked to show its net weight in addition to its contents.

1.07 QUALIFICATIONS

A. All the equipment specified under this Section shall be furnished by a single manufacturer and shall be standard units of proven ability as manufactured by a competent organization that is fully experienced, reputable, and qualified in the manufacture of the equipment to be furnished. The equipment shall be designed, constructed, and installed in accordance with the best practice and shall operate satisfactorily when installed.

B. All equipment furnished under this Section shall be new and unused and shall be the standard products of manufacturers having a successful record of

manufacturing and servicing the equipment and systems specified in this Section for a minimum of 5 years.

C. Any additional equipment necessary for the proper operation of the proposed installation not specifically mentioned in these Specifications or shown on the Drawings shall be furnished and installed at no change in Contract price or Time.

1.08 TESTING REQUIREMENTS

A. Testing shall be performed as specified in Part 2 and Part 3 of these Specifications.

1.09 MAINTENANCE

A. Spare Parts

1. The Contractor shall furnish the following spare parts in accordance with the requirements of Section 01600, Material and Equipment:

    a. One set of lower bearing seals.
    b. One grease pump pumping element kit.
    c. Manufacturer recommended spare parts for three units.

2. Spare parts shall be individually boxed with the project name and part number clearly identified on each individual box. All spare parts shall be shipped in a separate crate and clearly labeled. Spare parts shall be stored indoors by the Contractor in a temperature-controlled environment.

B. Special Tools

1. The Contractor shall furnish one set of all special tools required for normal operation and maintenance of the equipment.
2. Tools shall be furnished in a suitable steel case, clearly and indelibly marked on the exterior to indicate the equipment for which the tools are intended.

1.10 SYSTEM DESCRIPTION

A. All of the equipment included in this Section is intended to be standard for open screw pump applications.

B. The open screw pumps shall be as described in Table 11310-1 of these Specifications.

Table 11310-1 Screw Pump Design Requirements	
Number of Units	3
Pump Capacity	14,931-gpm
Hydraulic Lift (1)	11.80-feet
Angle of Inclination (1)	38-degrees
Pump Diameter	80-inch
Number of Flights	3
Flight Thickness	0.3125-inch
Torque Tube Diameter	36-inch
Torque Tube Wall Thickness	0.375-inch
Minimum Lower Bearing Diameter	6-inch
Minimum Upper Bearing Diameter	9-inch
Maximum Rotational Speed	34-rpm
Minimum Speed Reducer Torque Rating	165,247-in-lbs
Motor Size	75-hp
Electrical Power Characteristics	460V/60Hz/3ph
Motor and Solenoid Valve Electrical Classification	Non-Hazardous

Note: (1) The Contractor shall field-verify the dimensions as directed by the pump manufacturer and include the dimensions in the shop drawings.

C. Pumps shall be capable of successful operation without motor overload and without excessive vibration.

1.11 OPERATIONS AND MAINTENANCE (O&M) MANUALS

A. The manufacturer shall provide O&M manuals for the specific equipment with appropriate model numbers, pump curves, and motor data specific for this project. O&M manuals shall be in accordance with General Conditions, Supplementary Conditions, and Section 01830, Operations and Maintenance Manuals.

PART 2 PRODUCTS

2.01 MATERIALS AND EQUIPMENT

A. The pumping units required under this Section shall be complete including pumps and motors with proper alignment and balancing of the individual units. All parts shall be designed and proportioned to have liberal strength, stability, and stiffness and to be especially adapted for the service to be performed. Ample room for inspection, repairs, and adjustment shall be provided.

B. Pumps and drives shall be rigidly and accurately anchored into position. All necessary bolts, nuts, and washers shall be furnished by the Contractor. Anchor bolts, nuts, and washers shall be ASTM A276/A276M Type 302 stainless steel.

C. Each equipment item shall be furnished with a stainless steel nameplate (with embossed data) securely mounted to the body of the equipment. At a minimum, the nameplate for the pumps shall include the manufacturer's name and model number, serial number, rated flow capacity, speed, and all other pertinent data. At a minimum, nameplates for motors shall include the manufacturer's name and model number, serial number, horsepower, speed, input voltage, amps, number of cycles, and power and service factors. Nameplate information for the adjustable-speed drives shall include the manufacturer's name and serial number, input speed, voltage, current and frequency, and horsepower at full load.

D. All working parts of the pumps, motors, and drives, such as bearings, wearing rings, shaft, sleeves, etc., shall be standard dimensions built to limit gauges or formed to templates so that parts will be interchangeable between like units and so that the Owner may, at any time in the future, obtain replacement and repair parts for those furnished in the original machines. All parts shall be properly stamped for identification and location in the machines as shown on the assembly drawings in the Operation and Maintenance Manuals furnished.

E. The nameplate ratings of the motors shall not be exceeded nor shall the design service factor be reduced when the pump is operating at any point on its characteristic curve.

F. Mechanical equipment, including drives and electric motors, shall be supplied and installed in accordance with applicable OSHA regulations.

2.02 PUMPS

A. General

1. The pumps shall be of the open screw type designed to pump raw wastewater.

2. The pumps shall be as manufactured by:

    a. The Lakeside Equipment Corporation of Bartlett, Illinois.
    b. Engineer-approved equal.

B. Performance Requirements

1. When operating at the maximum output speed of the motor, each pump shall have a characteristic performance curve that meets all the minimum conditions listed in Table 11310-1. The pumps and drive motors shall be capable of operating satisfactorily under the full range of conditions as

defined by Table 11310-1. The primary pump capacity, head, and efficiency defined in Table 11310-1 shall be the "design point."

2. With the pumping units operating at full motor speed, the maximum brake horsepower required by the pumps shall not exceed the maximum horsepower listed in Table 11310-1. If the pumping units require more than the maximum horsepower listed in Table 11310-1 at the motor output shaft at any full motor speed operation point, they will be rejected.

2.03 SPIRAL SCREW

A. Spiral screw shall be fabricated of ASTM A36/A36M steel. Each spiral screw shall have an outside diameter as noted in Table 11310-1 with the number of flights as noted in Table 11310-1. Flights shall be die formed with a 1:1 pitch-to-diameter ratio and shall have a minimum thickness as noted in Table 11310-1. Flights shall be helical shaped and continuously welded on both sides to the torque tube. There shall be no more than two flight butt welds per pitch, and all flight butt welds shall be full penetration joints. The screw shall be designed to rotate counter-clockwise when viewed from the lower bearing end up toward the drive assembly.

B. Each torque tube shall have a minimum diameter as noted in Table 11310-1 with a minimum wall thickness as noted in Table 11310-1 so that screw deflection shall not be greater than the bearing center distance divided by 2,000. Calculations for deflection and bearing loads shall be based on the dead weight of the screw plus the full weight of liquid being pumped. Decreased loading from buoyance effects shall not be considered in the design calculations.

C. The torque tube shall be sealed watertight with a welded steel plate at each end. All surfaces of the end plates mating with the bolted stub shafts shall be finish-machined while the pump is supported between centers in a lathe after welding to the support tube and after all flight welding is complete to ensure alignment and parallelism.

D. A solid steel upper drive shaft and lower stub shaft fitted with machine faced steel plate flange shall be fastened to the upper and lower ends of the fabricated spiral screw with ASTM F3125/F3125M high-strength bolts.

E. The screw shall be placed in a lathe, and the flights shall be ground to a true radius after fabrication.

2.04 LOWER BEARING ASSEMBLY

A. The lower bearing assembly shall be a cam-type with a pressure-grease-lubricated bronze sleeve bearing pressed onto the shaft and shall carry the radial load of the

screw. Lower bearing nominal diameter shall be as noted in Table 11310-1. No thrust load shall be carried by the lower bearing.

B. The bronze sleeve shall rotate with the lower stub shaft in a bearing housing containing a minimum of two spring-loaded lip seals at the top of the bearing assembly. The seals shall be arranged so that one seal excludes wastewater and contaminants from the bearing and the other holds the grease in the bearing. The use of less than two lip seals shall not be acceptable.

C. The bearing assembly shall permit precise angular (vertical) and lateral (horizontal) field adjustment to eliminate misalignment between the upper and lower bearings without the use of shims. Bearing assembly shall accommodate all static and operating deflections of the screw. Bearings with fixed or rigid shafts and housings shall not be acceptable.

D. The bearing assembly shall be supplied with a split non-rotating shield installed between the housing and rotating screw for operation of the shaft and seals.

E. The bearing assembly shall accommodate thermal expansion and contraction of the screw within the bearing housing on fully lubricated surfaces not subject to corrosion or seizure.

F. The bottom of the bearing housing shall be fitted with an inspection plate that can be removed for inspection of the lower bearing without disassembly of the lower stub shaft or bearing housing.

G. The use of roller or ball bearings shall not be acceptable.

H. There shall be a flow through grease system with grease entering the lower part of the housing and passing across the full face of the bearing sleeve to the upper seals, then to a grease collection container for confirmation the bottom bearing is receiving grease from the automatic lubrication system.

2.05 UPPER BEARING ASSEMBLY

A. The upper stub shaft shall be a one-piece fabricated steel or forged steel design. Two-piece stub shaft designs (shaft and mating flange) shall not be acceptable for this project.

B. The upper stub shaft shall extend through a grease-lubricated upper bearing assembly that shall consists of a split housing fitted with dual bearings, lower spring loaded lip seal, bearing spacer, and upper spring loaded lip seal. Upper bearing nominal diameter shall be as noted in Table 11310-1.

C. All of the thrust load from the pump shall be carried by a spherical thrust-type bearing assembly, and the upper screw pump radial load shall be carried by a spherical roller bearing. A single dual-purpose bearing shall not be acceptable.

D. The two bearings (radial and thrust) shall be positioned in the bearing housing so that the pressure center of the thrust bearing and radial bearing intersects the axis of the screw at the same point to provide true self-alignment in all planes.

E. Both radial and thrust bearings shall be rated at a minimum of 100,000 hours AFBMA L10 theoretical design life, based on the dead weight of the screw plus the full weight of the liquid being pumped.

F. Upper stub shaft shall be grooved and positively locked into the upper bearing assembly by a split collar and locking halter ring. Use of threaded nuts to lock bearings and shafts for support of thrust loading shall not be acceptable.

G. A split-bearing housing shall be provided to allow removal of the cover for inspection of the bearings without removing the stub shaft or the entire bearing assembly.

2.06 DRIVE ASSEMBLY

A. The drive assembly shall be designed and constructed for a maximum screw rotational speed as noted in Table 11310-1. The drive assembly shall consist of a parallel-shaft speed reducer, belts, sheaves, motor, and coupling.

B. The speed reducer shall be a parallel-shaft, triple reduction, foot-mounted unit suitable for outdoor operation. Speed reducer sizing shall be based on the latest AGMA standards using a minimum 1.5 service factor based on the maximum torque requirements of the screw or a minimum 1.25 service factor based on motor horsepower, whichever is greater. The minimum speed reducer torque rating shall be as noted in Table 11310-1.

C. The speed reducer housing shall be manufactured from high-quality cast iron accurately machined for perfect alignment of all shafts and gearing. The speed reducer housing shall be furnished complete with an air breather, drain plug, dipstick or oil level indicator, and an inspection cover. All casting joints shall be precision ground to ensure an oil-tight and dust-proof housing.

D. The gearing shall be high-quality alloy steel, hobbed, and ground for maximum accuracy. All shafts shall be supported by roller-type anti-friction bearings.

E. The gearing and bearings shall be automatically splash or force-feed lubricated. Force-feed lubrication systems shall include a shaft-driven oil pump, and all

necessary piping integral shall be mounted on the gear reducer. Oil cooling shall be accomplished by convection and shall not require an external cooling source.

F. The low-speed and high-speed shafts shall be provided with spring-loaded lip seals suitable for inclined mounting.

2.07 BELTS AND SHEAVES

A. Power transmission from the motor to the reducer shall be by means of a set of V-belts and sheaves. Belts and sheaves shall be designed with a 1.5 service factor based on full motor horsepower.

B. Sheaves shall be two section units for both drive and driven sheaves and shall consist of a tapered split shaft bushing with three tapped holes to which the sheave is attached by three cap screws. Changing sheaves shall not require a wheel puller.

C. Belts and sheaves shall be covered with a fabricated aluminum belt guard in accordance with OSHA standards.

2.08 MOTOR

A. Motors shall be designed to accept all loads imposed by the pump during starting and running.

B. Motors shall be built in accordance with the latest NEMA, IEEE, ANSI, and AFBMA standards where applicable.

C. Each unit shall be driven by an 1,800 rev/min, 1.15 service factor, horizontal, ball bearing, continuous duty, constant speed, Design B, normal starting torque, totally enclosed fan-cooled, premium-efficiency, foot-mounted motor with leads to gasketed conduit box for outdoor operation.

D. Motor size, electrical power characteristics, and electrical environment shall be as noted in Table 11310-1.

E. Motor shall be mounted on a fabricated steel plate, which provides adjustment of belt slack.

2.09 FLEXIBLE LOW-SPEED COUPLING

A. The upper stub shaft of the screw pump shall be connected to the drive assembly by a flexible coupling.

B. Coupling shall be designed for a 1.5 service factor, based on brake horsepower, and shall be keyed and bored to suit the reducer slow speed shaft and the screw pump upper stub shaft.

C. The flexible coupling shall be covered with a removable aluminum guard in accordance with OSHA standards.

2.10 SUPPORT AND ANCHORAGE OF UPPER BEARING AND DRIVE ASSEMBLIES

A. For each screw pump installation, the Contractor is responsible for coordinating with the pump manufacturer and verifying that the existing concrete support is of sufficient size and strength for supporting the upper bearing and drive assemblies.

B. The existing concrete supports shall be prepared as shown on the Drawings.

C. The upper bearing and drive assemblies shall be rigidly and accurately anchored into position into to the existing concrete support with epoxy embedded anchor bolts. All anchor bolts, nuts, and washers shall be Type 304 stainless steel and shall be furnished by the pump manufacturer. The size, length, and depth of embedment of the anchors shall be per the manufacturer's recommendations. Expansion-type anchors shall not be acceptable.

D. Anchor bolts shall be set by the Contractor. Equipment shall be placed on the foundations, leveled, shimmed, bolted down, and grouted with a non-shrinking grout.

2.11 DEFLECTION PLATES

A. A flow deflection plate shall be provided to curve around the upper section on the uptake side of the screw to deflect the liquid as the screw rotates.

B. The flow deflection plate shall be fabricated of not less than 3/16-inch thick AISI Type 304 stainless steel plate complete with stiffeners where required and stainless steel anchors on 2-foot centers at the bottom edge.

C. The deflection plate top edge shall have adjustable stainless steel anchors at no more than 8-foot centers.

2.12 AUTOMATIC LUBRICATION SYSTEM

A. Each screw pump shall be furnished with a positive pressure, automatic lubrication pump and 3/8-inch minimum diameter stainless steel grease line.

B. The automatic lubrication pump shall provide grease lubricant to the lower bearing assembly with provisions at the pump to manually charge the grease line.

C. Each screw pump shall be furnished with a positive pressure, automatic lubrication pump with stainless steel grease reservoir, and 3/8-inch minimum diameter stainless steel grease line.

D. Each lubrication pump shall be adjustable and shall provide 6 ounces per day at the minimum setting and 17 ounces per day at the maximum setting (nominal). Grease reservoir shall hold a minimum of 15 pounds of lubricant.

E. The lubricant pump shall consist of an eccentric piston pumping element and a check valve and shall have a 1/3-horsepower, TEFC, ball bearing, gear motor connected to the lubricator by a flexible coupling. Grease pump motor shall be rated for electrical power characteristics and for an electrical environment as noted in Table 11310-1.

F. A centrifugal switch shall be furnished as an integral component of the grease pump and interlocked with the screw pump drive system. When the screw pump is required to operate, the lubrication pump motor shall switch on. As the lubrication pump motor reaches full speed, the centrifugal switch shall close, energizing the screw pump drive motor. If the grease pump motor stops, the centrifugal switch shall open, de-energizing the screw pump drive motor. The centrifugal switch shall be rated for no less than 3 amps at 120 VAC, resistive.

G. The lubrication system shall be factory-assembled on a steel-base plate or coordinated for connection to the existing structures as determined in the field. The coupling shall have a removable metal coupling guard in accordance with OSHA standards.

H. To protect the environment from contamination and to provide visual indication that the lower bearing is receiving a steady supply of lubricant, spent grease that has passed through the lower bearing shall be recovered in a stainless steel collection container with two 1/4-inch holes located 1 inch from the top of the container to allow liquid to drain out of the container.

2.13 GROUTING MATERIALS

A. Equipment manufacturer shall furnish a radius screed for the Contractor to place the finishing grout in the trough with the screw after the unit has been installed.

B. Equipment manufacturer shall loan to the Contractor additional sheave(s) and belts as required to operate the screw at a reduced speed for grouting the trough with the screw pump drive.

C. The finish grout for the trough shall be as specified as indicated on the Structural Drawings.

2.14 CONTROLS

A. Pump instrumentation and controls shall be integrated to existing.

2.15 SHOP SURFACE PREPARATION AND PAINTING

A. Before exposure to weather and before shop painting, all surfaces shall be thoroughly cleaned, dry, and free from all mill-scale, rust, grease, dirt, and other foreign matter.

B. All exposed portions of the pumps and motors shall be shop-primed in accordance with Section 09900, Painting and Coating. Primer shall be compatible with the finish paint specified in Section 09900, Painting and Coating.

C. Electric motors, speed reducers, and other self-contained or enclosed components shall be supplied with the manufacturer's standard finish coating.

D. Rust preventative compound shall be applied to all machined, polished, and nonferrous surfaces, which are not to be painted.

PART 3 EXECUTION

3.01 INSTALLATION

A. Installation shall be in strict accordance with the manufacturer's instructions and recommendations in the locations shown on the Drawings. Installation shall include furnishing the required grease for initial operation. The grades of grease shall be in accordance with the manufacturer's recommendations. Anchor bolts shall be set in accordance with the manufacturer's recommendations.

B. The Contractor shall submit a certificate stating that the installation is in accordance with the manufacturer’s instructions and NMAP Millwright standards.

C. The Contractor shall submit a certificate from the manufacturer stating that the installation of the equipment is satisfactory; that the equipment is ready for operation; and that the operating personnel have been suitably instructed in the operation, lubrication, and care of each unit.

3.02 FIELD PAINTING

A. The Contractor shall field touch-up the shop-applied primer coat in areas where the paint was damaged during shipping as soon as the equipment arrives on site. The coating shall be as specified in Section 09900, Painting and Coating.

B. The Contractor shall apply the intermediate and finish coats as specified in Section 09900, Painting and Coating.

C. The primer and paint used in the shop shall be products of the same manufacturer as the field paint to ensure compatibility.

D. All nameplates shall be properly protected during painting.

E. Before assembly, the Contractor shall coat all stainless steel bolts and nut threads with a non-seizing compound.

3.03 FIELD TESTING

A. Field tests shall not be conducted until such time that the entire installation is complete and ready for testing.

B. Field Pump Tests

1. After installation, the Contractor shall demonstrate to the Owner and Engineer that the installed equipment can perform satisfactorily under actual field conditions. The pumps shall be field-tested to verify mechanical integrity and soundness of construction, installation, and operation.
2. After the equipment has been operated long enough to make all desirable corrections and adjustments, each pumping unit and all associated equipment shall be field-tested to determine that operation is satisfactory, free from excessive vibration and noise, and in compliance with these Specifications.
3. If the pump performance, including vibration levels or natural frequency, does not meet the Specifications, corrective measures shall be taken or pumps shall be removed and replaced with pumps that satisfy the conditions specified, and the pumps shall be retested. A 24-hour operating period of the pumps shall be required before acceptance.
4. All pump operating settings, alarms, controls, and shutdown devices shall be calibrated and tested during the field tests.
5. The Contractor shall furnish all power, water, facilities, labor, materials, supplies, and test instruments required to conduct field test.

6. Upon completion of satisfactory testing of the equipment, the Contractor shall deliver to the Engineer reports as specified in Division 1, General Requirements.

C. Field Electric Control System Tests

1. The Contractor shall test-operate each drive and electric control system for proper functioning before the pump mechanical test. The control system shall be checked out using simulated operating signals in accordance with the drive manufacturer's recommendations.
2. Check all drives for correct clearances, alignment, and lubrication before start-up in accordance with the respective manufacturer's instructions.

D. Field Motor Tests

1. Megger each motor winding before energizing the motor, and, if insulation resistance is found to be low, notify the Engineer. Do not energize the motor.
2. Check all motors for correct clearances and alignment and for correct lubrication in accordance with the manufacturer's instructions. Check direction of rotation of all motors and reverse connections if necessary.
3. Perform all testing requirements as specified in Division 16, Electrical.

E. Field Alarm System Testing

1. Check each alarm and detection device for proper operation.

3.04 SOURCE QUALITY CONTROL

A. All structural steel components shall be fabricated in the United States and shall conform to the requirements of the "Specification for the Design, Fabrication and Erection of Structural Steel for Buildings" published by the AISC. Except where specifically indicated otherwise, all plates and structural members shall have a minimum thickness of 1/4 inch.

B. The equipment manufacturer's shop welds and welding procedures shall be in accordance with the requirements of the latest edition of ANSI/AWS D1.1 "Structural Welding Code - Steel" published by the AWS.

C. Design and fabrication of structural steel members shall be in accordance with AISC and AWS Standards. The manufacturer shall comply with the AWS and AISC most current listed standards and qualifications in AWS D1.1/D1.1M, the criteria in accordance with the requirements of Section 6 – Inspection – Structural

Welding Code. Evidence of such AWS and AISC compliance shall be submitted with shop drawing submittals as follows:

1. AWS Certified Welding Inspectors (minimum 2 on staff) shall conform to all standards, current or previous as listed in Section 6.1.4 AWS QC1, Specification for AWS Certification of Welding Inspectors.
2. AWS Non Destructive Testing Inspectors (Level I, II, III) for Magnetic Particle and Ultra-Sonic testing (minimum 2 on staff) shall conform to all standards, current or previous as listed in and in conformance with The American Society of Non-Destructive Testing (ASNT-TC-1A).

3.05 INSTALLATION

A. The manufacturer shall schedule three trips to the project site for equipment start-up assistance as noted in Paragraph 3.03.B. for the Contractor and for operating training as noted in Paragraph 3.06.A. for Owner personnel.

B. After the Contractor has installed the screen and the equipment is capable of being operated, the equipment manufacturer shall furnish a qualified representative in accordance with Table 11000-1 of Section 11000, General Equipment Requirements, to perform start-up inspection and training of the equipment for the Contractor.

3.06 OPERATOR TRAINING

A. The Contractor shall provide operator training for Owner's personnel after system is operational. Training will take place while manufacturer's representative is at the job site for inspection.

END SECTION

DIVISION 15

MECHANICAL

SECTION 15075
PROCESS EQUIPMENT, PIPING, AND VALVE IDENTIFICATION

PART 1 GENERAL

1.01 SCOPE OF WORK

A. This Section includes requirements for materials and installation of markers, labels, and signs for pipes, tanks, and valves; for mechanical equipment; for hazardous materials warnings; and for miscellaneous plant services.

1.02 SUBMITTALS

A. The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance.

B. The Contractor shall submit manufacturer's catalog data and descriptive literature describing materials, colors, letter size, and size of labels.

1.03 OPERATIONS AND MAINTENANCE (O&M) MANUALS

A. O&M Manuals shall be in accordance with General Conditions, Supplementary Conditions, and Section 01830, Operations and Maintenance Manuals.

PART 2 PRODUCTS

2.01 LABELS FOR MECHANICAL EQUIPMENT

A. The Contractor shall provide a label for each screw pump or other piece of mechanical equipment. The label shall show the equipment name and tag number as shown on the Tag Number list or on the Drawings. Labels shall be 1-1/2 inches (minimum) by 4 inches (minimum) brass, aluminum, or 1/8-inch-thick fiberglass tags.

2.02 UNDERGROUND PLASTIC WARNING TAPE FOR METAL PIPE

A. The Contractor shall provide permanent, bright-colored, continuous-printed plastic tape intended for direct burial service, not less than 6 inches wide by 3.5 mils thick. Provide tape with printing that most accurately indicates the type of service of buried pipe. Provide the following colored tape for the various piping services:

Service	Color
Cable TV	Orange
Gas	Yellow
Electric	Red
Telephone	Orange
Water	Blue
Sewer	Green
Chemical	Yellow
Reclaimed Water	Violet

2.03 UNDERGROUND DETECTABLE METALLIC PIPE WARNING TAPE

A. The Contractor shall provide permanent, bright-colored, continuous-printed tape consisting of an aluminum or steel foil sheathed in a plastic laminate, not less than 2 inches wide by 3 mils thick. Provide tape with printing that most accurately indicates the type of buried service. Provide the following colored tape for the various piping services:

Service	Color
Cable TV	Orange
Gas	Yellow
Electric	Red
Telephone	Orange
Water	Blue
Sewer	Green
Chemical	Yellow
Reclaimed Water	Violet

PART 3 EXECUTION

3.01 INSTALLING PIPE LABELS

A. The Contractor shall provide a label and flow arrow at each connection to pumps or other mechanical equipment, at wall boundaries, at tees and crosses, and at 20-foot centers on straight runs of piping.

B. On piping having external diameters less than 6 inches (including insulation, if any), the Contractor shall provide full-band pipe markers, extending 360º around pipe at each location.

C. On piping having external diameters of 6 inches and larger (including insulation, if any), provide either full-band or strip-type pipe markers but not narrower than

three times letter height (and of required length), fastened by one of the following methods:

1. Laminated or bonded application of pipe marker to pipe or insulation.
2. Strapped-to-pipe or insulation application of semirigid type with Type 304 or 305 stainless steel bands.

3.02 INSTALLING MISCELLANEOUS SIGNS

A. The Contractor shall attach miscellaneous signs according to the sign manufacturer's recommendations and in accordance with OSHA requirements.

3.03 INSTALLING UNDERGROUND PLASTIC WARNING TAPE FOR METAL PIPE

A. During backfilling of each exterior underground piping system, the Contractor shall install continuous underground-type plastic line marker directly over buried line at 6 to 8 inches above the top of the pipe. Where multiple small lines are buried in common trench and do not exceed overall width of 16 inches, install a single line marker.

3.04 INSTALLING UNDERGROUND DETECTABLE METALLIC PIPE WARNING TAPE

A. The Contractor shall install tape 4 to 6 inches below finished ground surface directly over buried pipelines. Where multiple small pipelines are buried in a common trench and do not exceed an overall width of 16 inches, install a single marker tape.

END OF SECTION

DIVISION 16

ELECTRICAL

SECTION 16050
ELECTRICAL – GENERAL PROVISIONS

PART 1 GENERAL

1.01 DESCRIPTION

A. Scope of Work

1. Furnish all labor, materials, equipment and incidentals required for a complete electrical system as hereinafter specified and shown on the Drawings, whether or not specifically shown or called for.
2. The work, apparatus and materials which shall be furnished under these Specifications and accompanying Drawings shall include all items listed hereinafter an/or shown on the Drawings. All materials necessary for the complete installation shall be furnished and installed by the Contractor to provide complete power, wiring and demolition as indicated on the Drawings and/or as specified herein whether or not specifically shown or called for. Certain equipment will be furnished as specified in other sections of these Specifications, which will require conduit and wire to complete the installation as required.
3. The Contractor shall furnish and install the necessary cables, transformers, motor control centers, protective devices (surge protection), conductors, exterior electrical system, etc., to serve motor loads, lighting loads and miscellaneous electrical loads as indicated on the Drawings and/or as specified hereinafter.
4. The work shall include complete testing of all equipment and wiring at the completion of the work and making any minor connection changes or adjustments necessary for the proper functioning of the system and equipment. All workmanship shall be of the highest quality; substandard work will be rejected.
5. Make all field connections to process instrument panels and other control panels furnished under other Divisions of these Specifications.
6. It is the intent of these Specifications that the electrical system shall be suitable in every way for the service required. All material, equipment, appliances and all work which may be reasonably implied as being incidental to the work of this Section shall be furnished at no extra cost.
7. Each bidder or his authorized representatives shall, before preparing a bid, visit all areas of the existing building and/or proposed site in which work will take place and be performed to carefully inspect the present installation and conditions. The submission of the bid by this bidder shall be considered evidence that the bidder has visited the project and noted the locations and conditions under which the work will be performed and that

the bidder takes full responsibility for a complete knowledge of all factors governing his work.

8. All necessary temporary power requirements are the responsibility of the Contractor and shall be furnished at no extra cost to the Owner.
9. All necessary temporary power, control and instrumentation requirements are the responsibility of the Contractor and shall be furnished at no extra cost to the Owner. Power and controls shall be furnished to all existing equipment at all times.

B. Service and Metering

1. Permanent electrical power and metering will be provided by the at 227/480 volts, three-phase, four-wire, wye, solid grounded, 60-Hertz.

C. Codes, Inspections, and Fees

1. All material and installation shall be in accordance with the latest edition of the National Electrical Code and all applicable national, local and state codes.
2. Pay all fees required for permits, inspections, and connections.

D. Tests

1. Test all systems and repair or replace all defective work. Make all necessary adjustments to the systems and instruct the Owner's personnel in the proper operation of the systems.

E. Interpretation of Drawings

1. The Drawings are not intended to show exact location, quantity or size of conduit runs. All installation of the raceway system shall be as directed by approved shop drawing. Any installation of a raceway system before shop drawing submittal and approval will at the sole risk of the Contractor.
2. All three-phase circuits shall be run in separate conduits unless otherwise shown on the Drawings.
3. Unless otherwise approved by the Engineer, conduit shown exposed shall be installed exposed; conduit shown concealed shall be installed concealed.
4. Where circuits are shown as "home-runs" all necessary fittings and boxes shall be provided for a complete raceway installation.
5. The Contractor shall harmonize the work of the different trades so that interferences between conduits, piping, equipment, architectural and structural work will be avoided. All necessary offsets shall be furnished so as to take up a minimum space and all such offsets, fittings, etc., required

to accomplish this shall be furnished and installed by the Contractor without additional expense to the Owner. In case interference develops, the Owner's authorized representative is to decide which equipment, piping, etc., must be relocated, regardless of which was installed first.

6. Verify with the Engineer exact locations and mounting heights of lighting fixtures, switches and receptacles before installation.
7. The locations of equipment, fixtures, outlets, and similar devices shown on the Drawings are approximate only. Exact locations shall be as approved by the Engineer during construction. Obtain in the field all information relevant to the placing of electrical work and, in case of any interference with other work, proceed as directed by the Engineer and furnish all labor and materials necessary to complete the work in an approved manner.
8. Surface mounted panel boxes, junction boxes, conduit, etc., shall be supported by spacers to provide a clearance between wall and equipment.
9. Circuit layouts shown are not intended to show the number of fittings, or other installation details. Furnish all labor and materials necessary to install and place in satisfactory operation all power, lighting, and other electrical systems shown. Additional circuits shall be installed wherever needed to conform to the specific requirements of the equipment.
10. The ratings of motors and other electrically operated devices together with the size shown for their branch circuit conductors and conduits are approximate only and are indicative of the probable power requirements insofar as they can be determined in advance of the purchases of the equipment.
11. All connections to equipment shall be made as shown, specified, required, and directed and in accordance with the approved shop drawings, regardless of the number of conductors shown on the Electrical Drawings.

F. Size of Equipment

1. Investigate each space in the building through which equipment must pass to reach its final location. If necessary, the manufacturer shall be required to ship his material in sections sized to permit passing through such restricted areas in the building.
2. The equipment shall be kept upright at all times. When equipment has to be tilted for each of passage through restricted areas during transportation, the manufacturer shall be required to brace the equipment suitably, to insure that the tilting does not impair the functional integrity of the equipment.

G. Component Interconnections

1. Component equipment furnished under this Specification will not be furnished as integrated systems.
2. Analyze all systems components and their shop drawings; identify all terminals and prepare drawings or wiring tables necessary for component interconnection.

H. Record Drawings

1. As the work progresses, legibly record all field changes on a set of project Contract Drawings.

1.02 SUBMITTALS

The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance:

A. Material and Shop Drawings

1. As specified under Section 01330, Submittals and Acceptance, shop drawings shall be submitted for approval of all materials, equipment, apparatus, and other items as required by the Engineer.

2. Shop drawings shall be submitted for the following equipment:

   a. Control Panels.
   b. Disconnect Switches.
   c. Wire and Cable.
   d. Supporting Devices.
   e. Test Data.

3. The manufacturers' name and product designation or catalog numbers shall be submitted for the following material:

   a. Conduit.
   b. Receptacles.
   c. Boxes and Fittings.
   d. Switches.

4. Before submittal by the Contractor, all shop drawings shall be checked for accuracy and contract requirements. Shop drawings shall bear the date checked and shall be accompanied by a statement that the shop drawings have been examined for conformity to Specifications and Drawings. This

statement shall also list all discrepancies with the Specifications and Drawings. Shop drawings not so checked and noted shall be returned.

5. The Engineer's check shall be only for conformance with the design concept of the project and compliance with the Specifications and Drawings. The responsibility of, or the necessity of, furnishing materials and workmanship required by the Specifications and Drawings which may not be indicated on the shop drawings is included under the work of this Section.

6. The responsibility for all dimensions to be confirmed and correlated at the job site and for coordination of this work with the work of all other trades is also included under the work of this Section.

7. No material shall be ordered or shop work started until the Engineer's approval of shop drawings has been given.

B. Manufacturer’s Services

1. Provide manufacturer's services for testing and start-up of the following equipment:

   a. Recycle Control Panels.

2. Provide manufacturers of the above listed equipment shall provide an experienced Field Service Engineer to accomplish the following tasks:

   a. The equipment shall be visually inspected upon completion of installation and before energizing to assure that wiring is correct, interconnection complete and the installation is in compliance with the manufacturer's criteria. Documentation shall be reviewed to assure that all Drawings, operation and maintenance manuals, parts list and other data required to check out and sustain equipment operation is available on site. Documentation shall be red-lined to reflect any changes or modifications made during the installation so that the "as-built" equipment configuration will be correctly defined. Spare parts shall be inventoried to assure correct type and quantity.
   b. The Field Service Engineers shall provide engineering support during the energizing and check out of each major equipment assembly. They shall perform any calibration or adjustment required for the equipment to meet the manufacturer's performance specifications.

c. Upon satisfactory completion of equipment test, they shall provide engineering support of system tests to be performed in accordance with manufacturer's test specifications.

d. Three 4-hour training sessions (one for each system) on operation, and two 4-hour training sessions (one for each system) on maintenance and trouble-shooting procedures shall be provided for the Owner's maintenance personnel. All training shall be conducted at a facility provided by the Owner. The maintenance and trouble-shooting sessions shall be conducted with record "as-built" electrical drawings sufficient for a class of eight personnel.

e. A final report shall be written and submitted to the Contractor within 14 days of completion of final system testing. The report shall document the inspection and test activity, define any open problems and recommend remedial action.

PART 2 PRODUCTS

2.01 MATERIALS AND EQUIPMENT

A. The materials used in all systems shall be new, unused and as hereinafter specified. All materials where not specified shall be of the very best of their respective kinds. Samples of materials or manufacturer's specifications shall be submitted for approval as required by the Engineer.

B. Materials and equipment used shall be Underwriters Laboratories, Inc. listed.

C. Electrical equipment shall, at all times during construction, be adequately protected against mechanical injury or damage by water. Electrical equipment shall not be stored out-of-doors. Electrical equipment shall be stored in dry permanent shelters. If any apparatus has been damaged, such damage shall be repaired by the Contractor at his own cost and expense. If any apparatus has been subject to possible injury by water, it shall be thoroughly dried out and put through such special tests as directed by the Engineer, at the cost and expense of the Contractor, or shall be replaced by the Contractor at his own expense.

D. Surface mounted raceways and boxes mounted on tanks. Tanks walkways shall be stainless steel as noted on drawings. All fasteners shall be Type 316 stainless steel.

PART 3 EXECUTION

3.01 INSTALLATION

A. Provide and place all sleeves for conduits penetrating floors, walls, partition, etc. Locate all necessary slots for electrical work and form before concrete is poured.

B. All cutting and patching shall be done in a thoroughly workmanlike manner.

3.02 INSPECTION AND TESTING

A. Test all systems and repair or replace all defective work. Make all necessary adjustments to the systems and instruct the Owner's personnel in the proper operation of the systems.

END OF SECTION

SECTION 16075
ELECTRICAL IDENTIFICATION

PART 1 GENERAL

1.01 SCOPE OF WORK

A. The Contractor shall furnish and install identification for raceways; power and control cables; conductors; underground-line warning tape, warning labels and signs; instruction signs; equipment identification labels; and any other miscellaneous identification products as shown in the Drawings and specified in this Section.

1.02 SUBMITTALS

The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance:

A. Product Data: For each electrical identification product indicated.

1.03 WORK SEQUENCE

A. The Contractor shall coordinate identification names, abbreviations, colors, and other features with requirements in other sections requiring identification applications; Drawings, Shop Drawings, manufacturer's wiring diagrams, and the Operations and Maintenance (O&M) Manual; and with those required by codes, standards, and 29 CFR 1910.145. Use consistent designations throughout the Project.

B. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

C. Coordinate installation of identifying devices with locations of access panels and doors.

D. Install identifying devices before installing acoustical ceilings and similar concealment.

1.04 REFERENCE STANDARDS

Reference standards and recommended practices referred to in this Section shall be the latest revision of any such document in effect at the bid time. The following documents are a part of

this Section. Where this Section differs from these documents, the requirements of this Section shall apply.

A. American National Standards Institute (ANSI)

1. ANSI Z535—Safety Alerting Standards.

B. American Society for Testing and Materials (ASTM)

1. ASTM D638—Standard Test Method for Tensile Properties of Plastics.
2. ASTM D882—Standard Test Method for Tensile Properties of Thin Plastic Sheeting.

C. American Society of Mechanical Engineers (ASME)

1. ASME A13.1—Scheme for the Identification of Piping Systems.

D. Institute of Electrical and Electronics Engineers (IEEE)

1. IEEE C2—National Electrical Safety Code.

E. Occupational Safety and Health Administration (OSHA)

1. 29 CFR 1910.144—Safety Color Code for Marking Physical Hazards.
2. 29 CFR 1910.145—Specifications for Accident Prevention Signs and Tags.

F. National Fire Protection Association (NFPA)

1. NFPA 70—National Electric Code.
2. NFPA 70E—Standard for Electrical Safety in the Workplace.

G. Underwriter's Laboratories (UL)

1. UL 969—Marking and Labeling Systems.

1.05 QUALITY ASSURANCE

A. Comply with ASME A13.1
B. Comply with NFPA 70.
C. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.
D. Comply with ANSI Z535.4 for safety signs and labels.

PART 2 PRODUCTS

2.01 POWER RACEWAY IDENTIFICATION MATERIALS

A. Comply with ASME A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway size.

B. Colors for Raceways Carrying Circuits at 600 V or Less:

1. Black letters on an orange field.
2. Legend: Indicate voltage.

C. Colors for Raceways Carrying Circuits at More Than 600 V:

1. Black letters on an orange field.
2. Legend: "DANGER: CONCEALED HIGH-VOLTAGE WIRING" with 3-inch-high letters on 20-inch centers.

D. Self-Adhesive Vinyl Labels for Raceways Carrying Circuits at 600 V or Less: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

E. Snap-Around Labels for Raceways Carrying Circuits at 600 V or Less: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeve, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

F. Snap-Around, Color-Coding Bands for Raceways Carrying Circuits at 600 V or Less: Slit, pretensioned, flexible, solid-colored acrylic sleeve, 2 inches long, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

G. Tape and Stencil for Raceways Carrying Circuits More Than 600 V: 4-inch-wide black stripes on 10-inch centers diagonally over orange background that extends the full length of raceway or duct and is 12 inches wide. Stop stripes at legends.

H. Metal Tags: Brass or aluminum, 2-inch-by-2-inch-by-0.05-inch with stamped legend, punched for use with self-locking cable tie fastener.

I. Write-On Tags: Polyester tag,0.015-inch thick, with corrosion-resistant grommet and cable tie for attachment to conductor or cable.

1. Marker for Tags: Marker for Tags: Machine-printed, permanent, waterproof, black ink marker recommended by printer manufacturer.

2.02 POWER AND CONTROL CABLE IDENTIFICATION MATERIALS

A. Comply with ASME A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway and cable size.

B. Snap-Around Labels: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeve, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

C. Snap-Around, Color-Coding Bands: Slit, pretensioned, flexible, solid-colored acrylic sleeve, 2 inches long, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

2.03 CONDUCTOR IDENTIFICATION MATERIALS

A. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils thick by 1 to 2 inches.

2.04 FLOOR MARKING TAPE

A. 2-inch-wide, 5-mil pressure-sensitive vinyl tape, with black and white stripes and clear vinyl overlay.

2.05 UNDERGROUND-LINE WARNING TAPE

A. Tape

1. Recommended by manufacturer for the method of installation and suitable to identify and locate underground electrical and communications utility lines.
2. Printing on tape shall be permanent and shall not be damaged by burial operations.
3. Tape material and ink shall be chemically inert and not subject to degrading when exposed to acids, alkalis, and other destructive substances commonly found in soils.

B. Color and Printing

1. Comply with ANSI Z535.1 through ANSI Z535.5.
2. Inscriptions for Red-Colored Tapes: ELECTRIC LINE, HIGH VOLTAGE.
3. Inscriptions for Orange-Colored Tapes: TELEPHONE CABLE, CATV CABLE, COMMUNICATIONS CABLE, OPTICAL FIBER CABLE.

C. Tag: Type I

1. Detectable three-layer laminate, consisting of a printed pigmented polyolefin film, a solid aluminum-foil core, and a clear protective film that allows inspection of the continuity of the conductive core, bright-colored, continuous-printed on one side with the inscription of the utility, compounded for direct-burial service.
2. Overall Thickness: 5 mils.
3. Foil Core Thickness: 0.35 mil.
4. Weight: 28 pounds/1,000 square feet.
5. 3-Inch Tensile According to ASTM D882: 70 lbf and 4,600 psi.

2.06 WARNING LABELS AND SIGNS

A. Comply with NFPA 70 and 29 CFR 1910.145.

B. Self-Adhesive Warning Labels: Factory-printed, multicolor, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment unless otherwise indicated.

C. Baked-Enamel Warning Signs

1. Preprinted aluminum signs, punched or drilled for fasteners, with colors, legend, and size required for application.
2. 1/4-inch grommets in corners for mounting.
3. Nominal size, 7 by 10 inches.

D. Metal-Backed, Butyrate Warning Signs

1. Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs with 0.0396-inch galvanized-steel backing; and with colors, legend, and size required for application.
2. 1/4-inch grommets in corners for mounting.
3. Nominal size, 10 by 14 inches.

E. Warning label and sign shall include but are not limited to the following legends:

1. Multiple Power Source Warning: "DANGER: ELECTRICAL SHOCK HAZARD – EQUIPMENT HAS MULTIPLE POWER SOURCES."

2. Workspace Clearance Warning: "WARNING: OSHA REGULATION – AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES."
3. Arc Flash Warning Label: Refer to NFPA 70E for arc flash warning label requirements.

2.07 INSTRUCTION SIGNS

A. Engraved, laminated acrylic or melamine plastic, minimum 1/16-inch thick for signs up to 20 square inches and 1/8-inch thick for larger sizes.

1. Engraved legend with black letters on white face.
2. Punched or drilled for mechanical fasteners.
3. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

B. Adhesive Film Label: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8-inch.

C. Adhesive Film Label with Clear Protective Overlay: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8-inch. Overlay shall provide a weatherproof and UV-resistant seal for label.

2.08 EQUIPMENT IDENTIFICATION LABELS

A. Adhesive Film Label: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8-inch.

B. Adhesive Film Label with Clear Protective Overlay: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8-inch. Overlay shall provide a weatherproof and UV-resistant seal for label.

C. Self-Adhesive, Engraved, Laminated Acrylic or Melamine Label: Adhesive backed, with white letters on a dark-gray background. Minimum letter height shall be 3/8-inch.

D. Engraved, Laminated Acrylic or Melamine Label: Punched or drilled for screw mounting. White letters on a dark-gray background. Minimum letter height shall be 3/8-inch.

E. Stenciled Legend: In nonfading, waterproof, black ink or paint. Minimum letter height shall be 1 inch.

2.09 CABLE TIES

A. General-Purpose Cable Ties: Fungus inert, self-extinguishing, one piece, self-locking, Type 6/6 nylon.

1. Minimum Width: 3/16-inch.
2. Tensile Strength at 73ºF, According to ASTM D638: 12,000 psi.
3. Temperature Range: Minus 40º to plus 185ºF.
4. Color: Black except where used for color-coding.

B. UV-Stabilized Cable Ties: Fungus inert, designed for continuous exposure to exterior sunlight, self-extinguishing, one-piece, self-locking, Type 6/6 nylon.

1. Minimum Width: 3/16-inch.
2. Tensile Strength at 73ºF, According to ASTM D638: 12,000 psi.
3. Temperature Range: Minus 40º to plus 185ºF.
4. Color: Black.

2.10 MISCELLANEOUS IDENTIFICATION PRODUCTS

A. Paint: Comply with requirements in Section 09900, Painting and Coating, for paint materials and application requirements. Select a paint system applicable for surface material and location (exterior or interior).

B. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

PART 3 EXECUTION

3.01 INSTALLATION

A. Verify the identity of each item before installing identification products.

B. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment. Align nameplates in center near the top of equipment being marked.

C. Apply identification devices to surfaces that require finish after completing finish work.

D. Attach signs and plastic labels with mechanical fasteners appropriate to the location and substrate.

E. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by the manufacturer of the identification device.

F. System Identification Color-Coding Bands for Raceways and Cables: Each color-coding band shall completely encircle cable or conduit. Place adjacent bands of two-color markings in contact, side by side. Locate bands at changes in direction, at penetrations of walls and floors, at 50-foot-maximum intervals in straight runs and at 25-foot-maximum intervals in congested areas.

G. Aluminum Wraparound Marker Labels and Metal Tags: Secure tight to surface of conductor or cable at a location with high visibility and accessibility.

H. Cable Ties: For attaching tags. Use general-purpose type, except as listed below:

1. Outdoors: UV-stabilized nylon.
2. In Spaces Handling Environmental Air: Plenum rated.

I. Underground-Line Warning Tape: During backfilling of trenches, install continuous underground-line warning tape directly above line at 12 inches below finished grade. Use multiple tapes where the width of multiple lines installed in a common trench or concrete envelope exceeds 16 inches overall.

J. Painted Identification: Comply with requirements in Division 9 Painting Sections for surface preparation and paint application.

3.02 IDENTIFICATION SCHEDULE

A. Identify all devices operating at more than 250 VAC phase-to-phase or 125 VAC phase-to-ground with red enamel letters or numerals of appropriate height applied with a stencil.

B. Accessible Raceways and Metal-Clad Cables, 600 V or Less, for Service, Feeder, and Branch Circuits More Than30 A, and 120 V to ground: Identify with self-adhesive vinyl label self-adhesive vinyl tape applied in bands. Install labels at 30-foot maximum intervals.

C. Accessible Raceways and Cables within Buildings: Identify the covers of each junction and pull box of the following systems with self-adhesive vinyl labels

with the wiring system legend and system voltage. System legends shall be as follows:

1. Emergency Power.
2. Power.
3. UPS.

D. Power wiring and control wiring shall be identified in all handholes with a waterproof permanent tag attached to the cable with plastic cable ties.

E. Conductors shall be identified at each termination, pull box, junction box, handhole, point of entry to or exit from wireways, panelboards, control panels, and other points of access. Tags or labels shall be securely affixed to the conductor in visible locations. Tags shall be durable plastic with the designation stamped on one side with suitable dies. Labels shall be permanent with legible black characters on white heat-shrink tubing or equivalent identification acceptable to the Owner.

1. Power-Circuit Conductor Identification, 600 V or Less: For conductors in vaults, pull and junction boxes, manholes, and handholes, use color-coding conductor tape to identify the phase. Tags or labels shall identify both the switchboard, MCC, panel, etc., it is served from and the circuit number.

2. Control conductor (including monitor and instrumentation conductors) shall be identified by color coding and tag or label as to wire number (corresponding to the manufacturer's wiring diagram) and equipment name.

3. Color-Coding for Phase and Voltage Level Identification, 600 V or Less: Use colors listed below for ungrounded service feeder and branch-circuit conductors.

    a. Color shall be factory applied or field applied for sizes larger than No. 8 AWG, if authorities having jurisdiction permit.

    b. Colors for 208/120V Circuits:

        (1) Phase A: Black.
        (2) Phase B: Red.
        (3) Phase C: Blue.

c. Colors for 480/277V Circuits:

(1) Phase A: Brown.
(2) Phase B: Orange.
(3) Phase C: Yellow.

d. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.

F. Power-Circuit Conductor Identification, more than 600 V: For conductors in vaults, pull and junction boxes, manholes, and handholes, use plastic tag holder with adhesive-backed phase tags, and a separate tag with the circuit designation.

G. Install instructional sign, including the associated color-code, for grounded and ungrounded conductors using adhesive-film-type labels.

H. Conductors to Be Extended in the Future: Attach identification tags to conductors and list source.

I. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.

1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
2. Use a system of marker tape designations that is uniform and consistent with the system used by the manufacturer for factory-installed connections.
3. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and the O&M Manual.

J. Locations of Underground Lines: Identify with underground-line warning tape for power, lighting, communication, and control wiring and optical fiber cable.

1. Limit use of underground-line warning tape to direct-buried cables.
2. Install underground-line warning tape for direct-buried cables and for cables in the raceway.

K. Workspace Indication: Install floor marking tape to show working clearances in the direction of access to live parts. Workspace shall be as required by NFPA 70 and 29 CFR 1926.403 unless otherwise indicated. Do not install at flush-mounted panelboards and similar equipment in finished spaces.

L. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Baked-enamel warning signs.

1. Comply with 29 CFR 1910.145.

2. Identify system voltage with black letters on an orange background.

3. Apply to exterior of door, cover, or other access.

4. For equipment with multiple power or control sources, apply to door or cover of equipment, including but not limited to the following:

a. Controls with external control power connections.

M. Operating Instruction Signs: Install instruction signs to facilitate proper operation and maintenance of electrical systems and items to which they connect. Install instruction signs with approved legend where instructions are needed for system or equipment operation.

N. Emergency Operating Instruction Signs: Install instruction signs with white legend on a red background with minimum 3/8-inch-high letters for emergency instructions at equipment used for power transfer.

O. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and the O&M Manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm systems unless equipment is provided with its own identification. Identification plates shall be furnished for lighting and power panelboards, motor control centers, all line voltage heating and ventilating control panels, fire detector and sprinkler alarms, door bells, pilot lights, disconnect switches, manual starting switches, magnetic starters, and process control devices.

1. Identification plates shall be furnished for all line-voltage enclosed-circuit breakers; the plates shall identify the equipment served, voltage, phase(s), and power source. Circuits 480 volts and above shall have conspicuously located warning signs in accordance with OSHA requirements.

2. Provide nameplates of minimum letter height as scheduled below:

a. Panelboards, switchboards, and motor control centers: 1/4-inch, identify panel name; 1/8-inch, identify voltage, phase, number of

wires, and source. Panelboards and control panels shall have designation in 1/4-inch high letters and voltage in 1/8-inch high letters centered above door on exterior trim.

b. Safety switches: same as above.

c. Safety color coding for identification of warning signs shall conform to NEMA Z535.

d. Red identification plates reading CAUTION: 480/277 VOLTS shall be provided in switch and outlet boxes containing 277- or 480-volt circuits. An identification plate marked DANGER: 480 VOLTS shall be provided on the outside of 480-volt enclosures. The identification plate shall use white lettering on a red laminated plastic.

3. Any equipment with externally powered wiring shall be marked with a laminated plaster name plate having 3/16-inch-high white letters on a red background as follows: DANGER: EXTERNAL VOLTAGE SOURCE.

4. Labeling Instructions:

a. Indoor Equipment: Self-adhesive, engraved, laminated acrylic, Unless otherwise indicated, provide a single line of text with 1/2-inch-high letters on 1-1/2-inch-high label; where two lines of text are required, use labels 2 inches high.

b. Outdoor Equipment: Engraved, laminated acrylic, or melamine label.

c. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.

d. Mark equipment mounted remotely from the source of power (such as pumps and fans) with equipment number, source of power, and starter location. Where starters are remotely mounted, marking shall include equipment name, number, and location.

e. Unless labels are provided with self-adhesive means of attachment, fasten labels with appropriate mechanical fasteners that do not change the NEMA or NRTL rating of the enclosure.

5. Equipment to be Labeled :

a. Panelboards: Typewritten directory of circuits in the location provided by the panelboard manufacturer. Panelboard identification shall be engraved label.

b. Enclosures and electrical cabinets.

c. Access doors and panels for concealed electrical items.

d. Switchboards.

e. Transformers: Label that includes tag designation shown on the Drawings for the transformer, feeder, and panelboards or equipment supplied by the secondary.
f. Emergency system boxes and enclosures.
g. Enclosed switches.
h. Enclosed circuit breakers.
i. Enclosed controllers.
j. Variable-speed controllers.
k. Push-button stations.
l. Power transfer equipment.
m. Contactors.
n. Remote-controlled switches, dimmer modules, and control devices.
o. Monitoring and control equipment.
p. UPS equipment.

END OF SECTION

SECTION 16110
RACEWAYS AND FITTINGS

PART 1 GENERAL

1.01 DESCRIPTION

A. Scope of Work

1. Furnish and install complete raceway systems as shown on the Drawings and as specified herein.

B. The complete above grade raceway system shall be rigid aluminum and polyvinyl chloride (PVC)-40 below grade.

1.02 QUALITY ASSURANCE

A. Qualifications

1. The equipment shall be products of manufacturers who are fully experienced, reputable and qualified in the manufacture of the equipment to be furnished. The system components shall be designed, constructed, delivered and installed in accordance with the best practices and methods.

B. Standards

1. Underwriters Laboratories, Inc. (UL)
2. American Society for Testing and Materials (ASTM)
3. Federal Specifications (FS)

C. Manufacturers

1. Non-Metallic Raceways:

a. Carlon.
b. Triangle Pipe and Tube Co.
c. Phillips Petroleum Co.
d. Indian Head Company.
e. Or equal.

2. Metallic Raceways:

a. Youngstown Sheet and Tube Co.
b. Allied Tube and Conduit Corp.
c. Wheeling-Pittsburg Steel Corp.
d. Or equal.

1.03 SUBMITTALS

A. Material and Shop Drawings

1. Copies of all materials required to establish compliance with these Specifications shall be submitted in accordance with the provisions of the General Conditions. Submittals shall include at least the following:

a. Certified shop drawings with performance data and physical characteristics.
b. Descriptive literature, bulletins, and/or catalogs of each item of equipment.
c. All information required by Section 01330, Submittals and Acceptance.
d. A complete total bill of materials for all equipment.

2. In the event that it is impossible to conform with certain details of the Specifications, describe completely all non-conforming aspects of the Shop Drawing transmittal.

PART 2 PRODUCTS

2.01 GENERAL

A. The Specifications are intended to give a general description of what is required, but do not cover all details which may vary in accordance with the exact requirements of the equipment as offered. They are, however, intended to cover the furnishing, delivery, installation and field testing of all materials, equipment and apparatus as required. Any additional auxiliary equipment necessary for the proper operation of the proposed installation not mentioned in these Specifications, or shown on the Drawings shall be furnished and installed.

B. The material covered by these Specifications is intended to be standard equipment of proven ability and as manufactured by reputable concerns having experience in the production of such equipment. The equipment furnished shall be designed, constructed, and installed in accordance with best practice and methods and shall operate satisfactorily when installed as shown on the Drawings.

2.02 MATERIALS AND EQUIPMENT

A. Metallic Conduit

1. ALUM conduit shall contain less than 0.1% copper and conform to FS WW-C-540C.

B. Non-Metallic Conduit and Fittings

1. PVC conduit shall be Schedule 80 composed of High Impact PVC (C-200 Compound), and shall conform to industry standards, and be UL listed in accordance with Article 347 of National Electrical Code for underground and exposed use. Materials must have tensile strength of 55 pounds per square inch (psi), at 70 degrees F, flexural strength of 11,000 psi, compression strength of 8600 psi. Manufacturer shall have 5 years' extruding PVC experience.
2. Liquidtight Flexible Conduit and Fittings shall be for use per Article 351 of the NEC. PVC compounds shall not include fillers. Fittings shall be manufactured from high impact PVC.

C. Liquidtight, Flexible Non-Metallic Conduit, Couplings, and Fittings

1. Liquidtight, flexible non-metallic conduit shall be all PVC conduit and manufactured by Thomas and Betts Co., K-Flex, Inc., or equal.
2. Fittings used with Liquidtight flexible conduit shall be of the non-metallic type as manufactured by the Thomas and Betts Co., Xtraflex System, K-Flex, Inc., or equal.

D. Flexible Couplings

1. Flexible Couplings shall be as manufactured by the Thomas and Betts Co., K-Flex, Inc., or equal.

E. Conduit hubs shall be as manufactured by Myers Electric Products, Inc., Raco Div., Appleton Electric Co., or equal.

F. Conduit wall seals shall be Type WSK as manufactured by the O.Z. Electrical Mfg. O., or equal.

G. Combination expansion-deflection fittings shall be Type XD as manufactured by the Crouse-Hinds Co., or equal.

PART 3 EXECUTION

3.01 INSTALLATION

A. Installation shall be in strict accordance with the manufacturer's instructions and recommendation, in the location shown on the Drawings.

B. No conduit smaller than 1/2-inch electrical trade size shall be used, nor any have more than three 90 degree bends in any one run. Pull boxes shall be provided as required or directed. Minimum size floor conduit shall be 3/4-inch.

C. No wire shall be pulled until the conduit system is complete in all details; in the case of concealed work, until all rough plastering or masonry has been completed; in the case of exposed work, until the conduit system has been completed in every detail.

D. The ends of all conduit shall be tightly plugged to exclude dust and moisture while the buildings are under construction.

E. Conduit supports shall be spaced at intervals of 4 feet or less, as required to obtain rigid construction. Conduit straps shall be type as manufactured by "CLIC".

F. Single conduits shall be supported by means of one-hole non-metallic pipe clamps in combination with one-screw back plates, to raise conduits from the surface. Multiple runs of conduits shall be supported on trapeze type hangers with fiberglass horizontal members and fiberglass treaded hanger rods. The rods shall be not less than 3/8-inch-diameter.

G. Conduit hangers shall be attached to structural steel by means of non-metallic beam or channel clamps. Where attached to concrete surfaces, concrete inserts of the spot type shall be provided.

H. All conduits on exposed work shall be run at right angles to and parallel with the surrounding wall and shall conform to the form of the ceiling. No diagonal runs will be allowed. Bends in parallel conduit runs shall be concentric. All conduit shall be run perfectly straight and true.

I. No broken run shall exceed 500 feet in length. This length shall be reduced by 75 feet for each 90-degree elbow.

J. Conduit terminating in boxes shall have sealing double lock-nuts and insulating bushings.

K. Conduit terminating in gasketed enclosures shall be terminated with sealing conduit hubs.

L. Conduit wall seals shall be used for all conduits penetrating walls below grade or other locations shown on the Drawings.

M. Liquidtight flexible metal conduit shall be used for all motor terminations and other outdoor equipment where vibration is present.

N. Flexible couplings shall be used in hazardous locations for all motor termination and other equipment where vibration is present.

O. Expansion fittings shall be installed in the following cases: In each conduit run wherever it crosses an expansion joint in the concrete building structure; in each conduit run which is mechanically attached to separate structures to relieve strain caused by shift on one structure in relation to the other; in straight conduit runs above ground which is more than one hundred feet long and interval between expansion fittings in such a run shall not be greater than 100 feet.

P. PVC joints shall be solvent welded. Threads will not be permitted on PVC conduit and fittings. Installation of PVC conduit shall be in accordance with manufacturer's recommendations. PVC conduit shall not be used to support fixture or equipment. Field bends shall be made with approved hotbox. Heating with flame and hand-held dryers are prohibited.

Q. Conduit installations on roofs shall be kept to a bare minimum. Conduit shall be supported above roof at least 6 inches using approved conduit supporting devices. Supports to be fastened to roof using roofing adhesive as approved by roofing contractor.

R. Cables in vertical raceways shall be supported as per NEC Article 300-19. Provide and install supporting devices for cables, including any necessary accessible pullbox as required regardless of whether shown on drawings or not. Provide and install access panels as required. Coordinate location of pull box and access panel with the Engineer before installation. This includes empty raceways for future use.

S. Provide and install pullboxes, junction boxes, fire barrier at fire rated walls, etc., as required by NEC Article 300, whether shown on drawings or not.

T. Paint all field cut threads and coat all aluminum conduits in contact with concrete per manufacture’s recommendations.

U. Raceways that do not have conductors furnished under this Division of the Specifications shall be left with an approved nylon pullcord in the raceway.

V. Grounding conductor shall be included in total conduit fill determining conduit sizes, even though not included or shown on drawings. Grounding conductors run with feeders shall be bonded to portions of conduit that are metal by approved ground bushings.

W. All aluminum conduits in contact with concrete shall be coated with bitumastic paint.

END OF SECTION

SECTION 16120
WIRES AND CABLES

PART 1 GENERAL

1.01 DESCRIPTION

A. Scope of Work

1. Furnish, install, and test all wire, cable and appurtenances as shown on the Drawings and as hereinafter specified.

B. General Design

1. Wire for lighting and receptacle circuits in the administration building shall be type THHN solid.
2. Wire for all power feeder and motor circuits outside of the administration building shall be type THHN stranded.
3. Single conductor wire for control, indication and metering shall be type THHN No. 14 AWG, stranded.
4. Multi-conductor control cable shall be No. 14 AWG, stranded tinned copper.
5. Wire for process instrumentation shall be No. 16 AWG, stranded tinned copper.
6. Except for control and signal leads, no conductor smaller than No. 12 AWG shall be used.

1.02 QUALITY ASSURANCE

A. Standards

1. Insulated Cable Engineers Association (ICEA)
2. Underwriters Laboratories, Inc. (UL)
3. American Society of Testing and Materials (ASTM)

B. Manufacturers

1. 600-volt wire and cable:

a. Hi-Tech Cable Corp.
b. Collyer Insulated Wire Co.
c. Okonite Co.
d. Rome Cable Co.

e. American Insulated Wire Corp.
f. Triangle PWC, Inc., or equal.

2. Instrumentation and Control Cable:

a. American Insulated Wire Corp.
b. Rome Cable Corp.
c. Okonite Co.
d. Eaton Corp. “Polyset”.
e. Triangle PWC, Inc., or equal.

3. Federal Specifications (FS)

1.03 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. All conductors shall be carefully handled to avoid kinks or damage to the insulation.

B. All conductors stored outdoors shall be covered.

PART 2 PRODUCTS

2.01 GENERAL

A. Wires and cables shall be of annealed, 98% conductivity, soft drawn copper conductors.

B. All conductors shall be stranded except lighting and receptacle circuits.

2.02 MATERIALS

A. 600-Volt Wire and Cable

1. Type THHN shall be polyvinyl chloride (PVC) insulation with nylon jacket.

B. Instrumentation and Control Cable

1. Process instrumentation wire shall be twisted pair, 600-volt, cross-linked polyethylene insulated, aluminum tape shielded, PVC jacketed, type "XLP". Multi-conductor cables with individually shielded twisted pairs shall be installed where indicated.
2. Multi-conductor control cable shall be stranded, 600-volt, cross-linked polyethylene insulated with PVC jacket, type "XLP".

C. Terminations and Splices

1. Unless otherwise indicated on the plans, no splices may be made in the cables without prior approval of the Engineer. Where splicing is approved, the splicing material shall be as recommended and approved by the cable manufacturer.

PART 3 EXECUTION

3.01 INSTALLATION

A. All conductors shall be carefully handled to avoid kinks or damage to insulation.

B. Lubrications shall be used to facilitate wire pulling. Lubricants shall be UL listed for use with the insulation specified.

C. Shielded instrumentation wire shall be installed from terminal to terminal with no splicing at any intermediate point.

D. Shielded instrumentation wire shall be installed in rigid steel conduit and pull boxes that contain only shielded instrumentation wire. Instrumentation cables shall be separated from control cables in manholes.

E. Shielding on instrumentation wire shall be grounded at one end only as directed by the supplier of the instrument.

F. Wire and cable connections to terminals, splices, and taps shall be made with compression connectors. Connections of insulated conductors shall be insulated and covered. All connections shall be made using materials and installation methods in accordance with instructions and recommendations of the manufacturer of the particular item of wire and cable. The conductivity of all completed connections shall not be less than that of the uncut conductor. The insulation resistance of all completed connections of insulated conductors shall be not less than that of the uncut conductor.

G. All wire and cable shall be continuous and without splices between points of connection to equipment terminals, except a splice will be permitted by the Engineer if the length required between the points of connection exceeds the greatest standard shipping length available from the manufacturer specified or as approved by the Engineer.

H. Installed, unapproved wire shall be removed and replaced at no additional cost to the Owner.

I. Steel fish tapes and/or steel pulling cables shall not be used in PVC raceway systems.

J. Remove debris and moisture from the conduits, boxes, and cabinets before cable installation and mandrel with device of one size smaller than conduit and mandrel with wire brush one size larger than conduit.

3.02 TESTS

A. All 600-volt wire insulation shall be tested with a megohm meter after installation. Tests shall be made at not less than 1000-VDC. A cable test data form shall be provided for Engineer review.

B. All service conductors shall be tested as in Paragraph A above. These tests shall be witnessed by the Engineer.

END OF SECTION

SECTION 16130
BOXES

PART 1 GENERAL

1.01 DESCRIPTION

A. Scope of Work

1. Furnish and install all junction boxes, pull boxes, and service entrance boxes for a complete raceway system as shown on the Drawings and as specified herein.

B. General Design

1. Unless otherwise hereinafter specified or shown on the Drawings, all boxes and fasteners shall be type NEMA 4X, Type 316-stainless steel.
2. All boxes in air-conditioning plenums above ceilings shall be pressed steel.
3. All boxes that do not receive devices are to have blank plates installed matching wiring device plates.

1.02 QUALITY ASSURANCE

A. Standards

1. Underwriters Laboratories, Inc. (UL)
2. Federal Specifications (FS)
3. American Society of Testing and Materials (ASTM)
4. National Electrical Code (NEC)

B. Manufacturers

1. Hoffman, Type CHNFSS.
2. Or equal.

1.03 SUBMITTALS

A. Materials and Shop Drawings

1. See Section 16050, Electrical – General Provisions.

1.04 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Boxes and fittings shall be stored indoors protected from damage.

1.05 WARRANTY AND GUARANTEES

A. All boxes and fittings shall be warranted against defects or failure for a period of 1 year from date of acceptance.

PART 2 PRODUCTS

2.01 MATERIALS

A. Boxes shall be constructed as follows:

1. 14-gauge Type 316L stainless steel.
2. Continuously welded and ground smooth, no holes or knockouts.
3. Seamless foam in-place gasket, watertight, dust-tight.
4. Stainless steel screws and clamps.

PART 3 EXECUTION

3.01 INSTALLATION

A. All boxes shall be supported away from surfaces.

B. All boxes shall be sized in accordance with the National Electrical Code (NEC).

C. All conduit entries into boxes shall not lower or change the NEMA rating of the box.

END OF SECTION

SECTION 16140
WIRING DEVICES

PART 1 GENERAL

1.01 DESCRIPTION

A. Scope of Work

1. Furnish and install wiring devices and all necessary accessories and appurtenances required as hereinafter specified and shown on the Drawings.

2. Wiring devices shall include the following:

a. Wall switches.
b. Device plates.
c. Plugs.
d. Receptacles.
e. Lighting control time clocks.
f. Lighting contactors.
g. Control stations.
h. Ground fault interrupter receptacles.

B. Related Work Described Elsewhere

1. Section 16050, Electrical – General Provisions.
2. Section 16110, Raceways and Fittings.

1.02 QUALITY ASSURANCE

A. Standards

1. Underwriters Laboratories, Inc. (UL)
2. National Electrical Manufacturers Association (NEMA)
3. National Electrical Code (NEC)
4. Federal Specifications (FS)

B. Manufacturers

1. Wall switches, device plates, plugs, and receptacles as follows:

a. Arrow-Hart.

b. Bryant.
c. Hubbell.
d. Leviton.
e. Or equal.

2. Clocks:

a. Simplex.
b. Or equal.

3. Lighting contactors:

a. Square-D.
b. Cutler-Hammer.
c. Or equal.

4. Dimmer controls:

a. Leviton.
b. Prescolite.
c. Or equal.

5. Control stations:

a. Hoffman Engineering Co.
b. Square-D.
c. Crouse-Hinds.
d. Or equal.

1.03 SUBMITTALS

A. Materials and Shop Drawings

1. Submit material list and catalog cut-sheets for all items covered under this Section. Indicate type, ratings, material, color, and manufacturer.

1.04 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. All devices covered under this Section shall be stored indoors, protected from damage.

PART 2 PRODUCTS

2.01 MATERIALS

A. Switches

1. Wall switches shall be of the indicating, toggle action, flush mounting quiet type. All switches shall conform to FS W-S-896-D.

2. Wall switches shall be of the following types and manufacturer or equal. Any reference to a specific figure number of a specific manufacturer is for the purpose of establishing a type and quality of product and shall not be considered as proprietary.

   a. Single-pole – Arrow-Hart, Catalog No. 1991.
   b. Double-pole – Arrow-Hart, Catalog No. 1992.
   c. Three-way – Arrow-Hart, Catalog No. 1993.
   d. Four-way – Arrow-Hart, Catalog No. 1994.
   e. Single-pole, key-operated – Arrow-Hart Catalog No. 11991-L.
   f. Momentary contact, two-circuit, center-off – Arrow-Hart, Catalog No. 1895.
   g. Weatherproof cover for Arrow-Hart 2900 series tap action switches – Arrow-Hart Catalog No. 2881-G.

B. Receptacles

1. Wall receptacles shall be of the following types and manufacturer or equal:

   a. Single, 20A, 125V, 1P, 3W – Arrow-Hart, Catalog No. 5351.
   b. Duplex, 20A, 125V, 1P, 3@ - Arrow-Hart, Catalog No. 5352.
   c. Weatherproof, 20A, 125V, 2P, 3W – Arrow-Hart, Catalog No. 5351 and WLRD-1 cover.
   d. Corrosion-resistant, duplex, 20A, 1 25V, 2P, 3W – Arrow-Hart, Catalog No. 5351 and WLRD-l cover.
   e. 60A, 480V, 3P, 2W – weatherproof receptacle shall be Crouse-Hinds Catalog No. ARE6324 with Crouse-Hinds Catalog No. APJ 6385 plug.
   f. Ground fault interrupter, duplex, 20A, 125V, 3P, 2W – Arrow-Hart Catalog No. GF5342.
   g. Stainless steel indoor mounting plate for G.F.I. receptacle – Arrow-Hart Catalog No. 97061.
   h. Weatherproof cover for G.F.I. receptacle in FS box – Arrow-Hart Catalog No. 4501-FS.

i. Clock hanger, 15A, 125V, 2P, 3DW – Arrow-Hart Catalog No. 452.
j. Single, 20A, 125V, 2P, 3W – Arrow-Hart Catalog No. 8510BL; cover – Arrow-Hart Catalog No. 9301C indoor, 7420C weatherproof.
k. Single, 30A, 125V, 2P, 3W – Arrow-Hart Catalog No. 5716N; cover – Arrow-Hart Catalog No. 9301C indoor, 7420C weatherproof.
l. Clothes dryer, 30A, 125/250V, 3P, 3W – Arrow-Hart Catalog No. 9344N. Matching cord set shall also be included.

C. Device Plates

1. Plates for flush mounted devices shall be of the required number of gangs for the application involved and shall be Type 302 (18-8) high nickel stainless steel of the same manufacturer as the device.

D. Lighting Contactor

1. Lighting contactors shall be of the electrically operated, electrically held type in NEMA 1 enclosures of the number of poles as called for on the Drawings.
2. Contactors shall be rated for 25A 600-volt contacts and be similar and equal to Automatic Switch Company bulletin 1255-166 RC.

E. Lighting Control Time Switches

1. Time switches for the control of lighting shall have astronomic dials, reserve power, and be similar and equal to the following types:

a. Where time switch is indicated to be for momentary contact operation it shall be similar and equal to Intermatic Inc. Catalog No. ET-70115-C.
b. Where time switch is indicated for SPST maintained control it shall be similar and equal to Intermatic Inc. Catalog No. V-45471-CR.
c. Where time switch is indicated for DPST maintained control it shall be similar and equal to Intermatic Inc. Catalog No. V-45471-CR.
d. Where time switch is indicated for roadway or equipment, lighting shall be similar or equal to Intermatic Inc. Catalog No. ET-7000 Series.

F. Control Stations

1. Control stations for start/stop pushbutton and hand-off-automatic selector switches shall be corrosion resistant, dust-tight, watertight, and weatherproof, NEMA 4X, 600 VAC, UL Standard 508 as manufactured by Crouse-Hinds Series NCS or equal.

PART 3 EXECUTION

3.01 INSTALLATION

A. Receptacles in process areas and shops shall be mounted 36 inches above the floor unless otherwise noted on the Drawings.

B. Receptacles in office and other like areas shall be mounted 18 inches above the floor unless otherwise noted on the Drawings.

C. Use bolt, screws, nuts, and other threaded devices having standard threads and heads so they may be installed and replaced without special tools.

D. Check light switch locations before rough-in to avoid installing a switch behind the door swing.

E. The Engineer and Owner reserve the right to change any switch or receptacle location within the same room, without added cost before rough-in.

F. Locate outlets intended for the supply of specific items such as water coolers, copying machines, fans, etc., as recommended by the item manufacturer.

END OF SECTION

SECTION 16170
SAFETY SWITCHES

PART 1 GENERAL

1.01 DESCRIPTION

A. Scope of Work

1. Furnish and install all motor and circuit disconnects as hereinafter specified and as shown on the Drawings.

B. General Design

1. All switches shall be heavy duty and have stainless steel NEMA 4X enclosures and be horsepower rated.
2. All switches shall have metal nameplates, front cover mounted that contain a permanent load, switch-type, catalog number, and HP ratings, handle whose position is easily recognizable and is padlockable in the "off" position, visible blades, reinforced fuse clips, nonteasible, positive, quick make-quick break mechanism, switch assembly plus operating handle as an integral part of the enclosure base.
3. Switches shall have defeatable door interlocks that prevent the door from opening when the operating handle is in the "on" position. All switches shall have line terminal shields.
4. All current carrying parts shall be copper.
5. Auxiliary contacts rated 10 ampere at 240 volts shall be provided for motor space heater interlock and position indication.

1.02 QUALITY ASSURANCE

A. Standards

1. National Electrical Manufacturers Association (NEMA)
2. Underwriters Laboratories (UL)
3. Federal Specifications (FS)
4. National Electrical Code (NEC)

B. Manufacturers

1. Switches shall be as manufactured by Square D Co. Class 9422, Cutler-Hammer, or equal.

1.03 SUBMITTALS

A. Materials and Shop Drawings

1. See Section 16050, Electrical – General Provisions.

1.04 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. All switches shall be stored indoors protected from damage.

1.05 WARRANTY AND GUARANTEES

A. All switches shall be warranted against defect, rusting, or failure for a period of 1 year from date of acceptance.

PART 2 PRODUCTS

2.01 MATERIALS AND EQUIPMENT

A. Where a six-pole weatherproof disconnect are called for on the Drawings, the Contractor shall provide two 600-Volt, three-pole non-fusible switches in a single NEMA 4X stainless steel enclosure with a single operating handle mechanically interlocked to both disconnects.

B. All parts exposed to the weather or in hose-down areas shall be stainless steel.

C. Short-circuit rating – 10,000 RMS symmetrical amperes for non-fused switches.

D. Line and load lugs shall be front removable and suitable for copper, 60/75-degree C wire through 200A sizes, 75-degree C wire for 400-800A sizes.

PART 3 EXECUTION

3.01 INSTALLATION

A. All switches shall be mounted as shown on the Drawings.

B. Location of disconnect switches shall be in accordance with the NEC and shall be verified with the Engineer before installation.

C. All mounting appurtenances shall be Type 316 stainless steel including fasteners.

END OF SECTION

SECTION 16450
GROUNDING SYSTEM

PART 1 GENERAL

1.01 DESCRIPTION

A. Scope of Work

1. Furnish and install a complete grounding system in strict accordance with Article 250 of the National Electrical Code and as hereinafter specified and shown on the Drawings.

B. Related Work Described Elsewhere

1. Section 16120, Wires and Cables.
2. Section 16110, Raceways and Fittings.

1.02 QUALITY ASSURANCE

A. Qualifications

1. The equipment shall be products of manufacturers who are fully experienced, reputable and qualified in the manufacture of the equipment to be furnished. The system components shall be designed, constructed, delivered and installed in accordance with the best practices and methods.

1.03 SUBMITTALS

A. Materials and Shop Drawings

1. Copies of all materials required to establish compliance with these Specifications shall be submitted in accordance with the provisions of the General Conditions. Submittals shall include at least the following:

   a. Certified shop drawings with performance data and physical characteristics.
   b. Descriptive literature, bulletins, and/or catalogs of each item of equipment.
   c. All information required by Section 01330, Submittals and Acceptance.

d. Complete wiring diagrams and schematics of all power and control systems showing wiring requirements between system and connections to work of other sections.

1.04 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver a complete system ready to install as job progress requires.

PART 2 PRODUCTS

2.01 GENERAL

A. The Specifications are intended to give a general description of what is required, but do not cover all details which may vary in accordance with the exact requirements of the equipment as offered. They are, however, intended to cover the furnishings, delivery, installation, and field testing of all materials, equipment, and apparatus as required. Any additional auxiliary equipment necessary for the proper operation of the proposed installation not mentioned in these Specifications or shown on the Drawings shall be furnished and installed.

B. The material covered by these Specifications is intended to be standard equipment of proven ability and as manufactured by reputable concerns having experience in the production of such equipment. The equipment furnished shall be designed, constructed, and installed in accordance with best practice and methods and shall operate satisfactorily when installed as shown on the Drawings.

2.02 MATERIALS AND EQUIPMENT

A. Ground rods: Ground rods shall be copper clad steel 3/4-inch x 20-foot, minimum depth. Ground rods shall be copperweld or equal.

PART 3 EXECUTION

3.01 INSTALLATION

A. The 480-volt switchgear ground bus shall be grounded to a ground loop system. The protecting conduits shall be bonded to the grounding conductor at both ends.

B. All steel building columns shall be bonded together and connected to the building ground grid.

C. Motors shall be grounded as hereinafter specified.

D. Lighting transformer neutrals shall be grounded to the nearest grounding electrode.

E. Grounding electrodes shall be driven as required. Where rock is encountered, grounding plates may be used in lieu of grounding rods.

F. All equipment enclosures, motor and transformer frames, conduits systems, cable armor, exposed structural steel, and similar items shall be grounded.

G. Exposed connections shall be made by means of approved grounding clamps. Exposed connections between different metals shall be sealed with No-Oxide Paint Grade A or equal. All buried connections shall be made by welding process such as Cadweld or equal.

H. For reasons of mechanical strength, grounding conductors shall be No. 10 AWG minimum copper, minimum size.

I. All underground conductors shall be laid slack and where exposed to mechanical injury, shall be protected by pipes or other substantial guards. If guards are iron pipe or other magnetic material, conductors shall be electrically connected to both ends of the guard.

J. The Contractor shall exercise care to ensure good ground continuity, in particular between the conduit system and equipment frames and enclosures. Where necessary, jumper wires shall be installed.

3.02 INSPECTION AND TESTING

A. The Contractor shall obtain the services of an NETA recognized testing firm to measure the ground resistance of the system. All test equipment shall be provided by the Contractor and approved by the Engineer. Dry season resistance of the system shall not exceed 5 ohms. If such resistance cannot be obtained with the system as shown, the Contractor shall provide additional grounding as directed by the Engineer, without additional payment.

END OF SECTION

SECTION 16900
SCREW PUMP LIFT STATION CONTROL PANEL

PART 1 GENERAL

1.01 DESCRIPTION

A. Scope of Work

1. Furnish, install, and test the three control panels as hereinafter specified and as shown on the electrical drawings.

1.02 QUALITY ASSURANCE

A. Standards

1. National Electric Code (NEC).
2. Underwriters Laboratories (UL).

B. Equipment Manufacturers

1. Rocha Controls
2. Revere Controls

1.03 SUBMITTALS

A. Submit detailed drawings concerning each control panel and all components including:

1. Cabinet assembly and layout drawings to scale.
2. Fabrication specifications with materials of construction of all components.
3. Point-to-point wiring diagrams depicting wiring within the panel and connection to external devices. Free-hand drawings are unacceptable.
4. Catalog cut sheets on all panel components with manufacturer's complete model number.

B. The data sheet and drawings shall be provided with an index and proper identification and cross-referencing. Each control panel shall be submitted in its entirety.

1.04 PRODUCT DELIVERY, STORAGE AND HANDLING

A. After completion of shop assembly, factory test, and approval, all equipment, cabinets, panels, and consoles shall be packed in protective crates and enclosed in

heavy duty polyethylene envelopes or secured sheeting to provide complete protection from damage, dust, and moisture. The equipment shall then be skid-mounted for final transport. Lifting rings shall be provided for moving without removing protective covering. Boxed weights shall be shown on shipping tags together with instructions for unloading, transporting, storing, and handling at job site.

B. Special instructions for proper field handling, storage and installation required by the Manufacturer for proper protection, shall be securely attached to each piece of equipment prior to packaging and shipment.

C. Each component shall be tagged to identify its location, tag number, and function in the system. Identification shall be prominently displayed on the outside of the package.

D. Equipment shall not be stored out-of-doors. Equipment shall be stored in dry permanent shelters and shall be adequately protected against mechanical injury. If any apparatus has been damaged, the Contractor at his own cost and expense shall repair such damage. If any apparatus has been subject to possible injury by water, it shall be thoroughly dried out and put through such tests as directed by the Engineer. This shall be at the cost and expense of the Contractor, or the Contractor at his own expense shall replace the apparatus.

1.05 WARRANTY AND GUARANTEES

A. The equipment manufacturer shall warrant the units being supplied to the Owner against defects in workmanship and materials for a period of 1 year from the date of equipment start-up and acceptance. If the equipment fails to perform as specified, the equipment manufacturer shall promptly repair or replace the defective equipment without any cost to the Owner.

PART 2 PRODUCTS

2.01 GENERAL

A. This Section specifies the control system requirements for recycling pumps. The minimum horsepower rating of pump station control panels shall be as shown on the plans. The panel shall be UL certified per 508a and withstand 22 kAIC SCCR.

B. The control panel shall contain switches and relays that automatically start and stop pumps as well as transmit an alarm upon starter failure. The control panel shall operate one (1) pump. The control panel shall provide relay connections to the City’s telemetry system for monitoring and off-site control of the pump.

C. All components shall be mounted in a manner that shall permit servicing, adjustment, testing, and removal without disconnecting, moving, or removing any other component. Components mounted on the inside of panels shall be mounted on a back plate and not directly to the enclosure. Mounting shall be rigid and stable unless shock mounting is required by the manufacturer to protect equipment from vibration. Component mounting shall be oriented in accordance with the component manufacturers and industry standard practices. All internal components shall be identified with suitable plastic or metal engraved tags attached with drive pins adjacent to (not on) each component identifying the component in accordance with the drawings, specifications, and supplier's data.

D. The control panel shall consist of a main breaker with a flange type disconnect, plus 20 amperes rated for 120-volt branch circuits related to controls and a remote 1/3-HP, 115-volt grease pump, as required. Control switches shall provide means to operate pump manually or automatically.

E. Control Panel Construction

1. Panel Details:

a. The control panel shall be housed in a NEMA 4, 12-gauge painted steel enclosure with extra mounting space for additional equipment. The enclosure shall provide pad locking the door and #11-gauge aluminum inner door for mounting control devices. The panels shall be wired and assembled per UL 508 Standards. All electrical components and materials shall be listed by UL and shall bear the appropriate UL listing mark or classification. Each panel shall be listed and labeled as UL 508 Industrial MCC. Panels shall comply with NFPA 79, Industrial Machinery. A permanent, non-paper wiring diagram shall be mounted on the inside of the cabinet door.

b. There shall be permanently affixed to the interior side of the exterior enclosure door both a nameplate and a 10-inch-by-12-inch pocket for log storage. The nameplate shall contain the voltage, phase, rated horsepower, speed, date of manufacture, pump and panel manufacturer's name, address and telephone number, pump data.

c. Panel mounted controls and indicators shall maintain panel integrity. Suitable stiffness shall be provided when required to maintain flatness and provide extra rigidity.

d. Terminal blocks shall be separated into groups (power, AC control, DC signal, data, etc.). All terminals shall be marked with legible permanent labels or otherwise identified.

e. The control panel shall include at a minimum: a grease pump circuit breaker.

f. Surge protector equipment in accordance with UL 1449 Standards shall be installed on the load side of the main circuit breaker for protection of all AC electrical equipment in the control panel and the motors from the effects of lightning induced currents, substation switching transients, and internally generated transients.

2. Motor Starters:

a. Soft Starter Solid State:

(1) Solid-state reduced voltage starters shall be digitally controlled to provide smooth, stepless acceleration of three-phased induction squirrel cage motors. This shall be accomplished by use of six back-to-back SCR's connected in reverse parallel arrangement, mounted on a common heat sink. The starter shall provide an adjustable smooth acceleration and deceleration.

(2) Each starter pole shall contain two SCR's with sequentially fired phase-controlled circuit. Each starter shall include an integral thermal sensor to trip and disengage starter on heat sink overtemperature. Starter shall use digital microprocessor. Starter shall include programmable keypad and alphanumeric LED display that actively indicates present mode of operations. Starter shall include error tractability (of last four events) for taking equipment corrective actions.

(3) Solid-state reduced voltage starters shall be listed and/or classified by Underwriters Laboratories UL 508, UL 845, and ISO 9000 compliant.

(4) Solid state starters shall be manufactured by Square-D Altistart 22 or Allen-Bradley SMC-3.

3. Circuit Breakers:

a. All circuit breakers shall have an appropriate locking device to meet OSHA lockout and tag-out rules. All circuit breakers shall be heavy duty molded case breakers rated 22 KAIC. The handle on the circuit breakers shall be operational through the inner door.

b. Dedicated Branch Breakers:

(1) Grease pump.

(2) Controls.

4. Control Relays:

    a. The control relays shall operate from a 24-volt circuit. The relays shall be enclosed, eight-pin and/or eleven-pin plug-in type. The control relays shall contain test button and neon or LED energized indicator. The plug base shall be keyed to allow for proper pin alignment.

5. Control Relay Sockets:

    a. Control relay sockets shall be octal style with clamp on screw terminals. These sockets shall be 600 VAC rated and mounted on DIN railing. All relay sockets shall be keyed to allow for proper pin alignment.

6. Control Terminal Blocks:

    a. Control terminal blocks shall be clamp screw type and rated for 600 volts. The amperage rating of control terminal blocks shall accommodate the amperage of the circuit to which it is connected but have a minimum rating of 20 amps. An additional 30-space terminal strip shall be installed in the panel for future expansion.

7. Control Power Transformers:

    a. The 480-120 VAC transformer shall be a properly sized capable of meeting the needs of the control system and grease pump. The transformer shall contain a fused secondary. In 480-volt AC applications, a fused control circuit transformer shall be supplied to provide 120 volts AC auxiliary equipment power. The power transformer shall be dry and properly fused on both the primary and secondary side of the transformer.

8. Selector Switches:

    a. Selector switches shall be installed on the face of the inner door unit. Selector switches shall contain heavy duty "Hand-Off-Auto" three position switches to control the operation mode of each pump motor starter.

9. Indicator Lights:

    a. On the face of the inner door unit, heavy duty LED indicator lights shall be installed. The lights shall indicate the control status of the

float control switches, the run condition of the pumps and the condition of the moisture sensor in each pump. The indicator lights shall be 120-volt.

10. Elapsed Time Meters:

    a. Elapsed time meters shall be mounted on the face of the inner door unit with one for each pump. These meters shall be 115-volt non-resettable type and totalize pump-running time in hours and tenths of hours to 99999.9 hours. Elapsed Time Meter:
    ETMAC 200-10NG7 Round Mount.

11. Convenience Receptacle:

    a. A 15-amp, 120-volt, duplex convenience receptacle shall be installed on the face of the inner door unit. The receptacle shall contain a single pole, 15-amp circuit breaker for protection. Ground fault interrupt type shall be required.

12. Wiring:

    a. All power wires shall be THW, or THWN 75-degree C insulated stranded copper conductors and appropriately sized for the load application. All control circuit wire shall be Type THW, 14 AWG, stranded type copper. All wiring within the enclosure shall be neatly routed by the use of slotted type wiring duct with snap on type covers. Wiring on the rear of the inner door shall be neatly bundled with spiral wiring loom and include a sufficient loop across the hinges to prevent wire binding or damage. Both ends of each conductor shall be permanently identified. Color-coding of all wiring is required: RED = 24VAC+; WHITE = Neutral; BLACK = 102VAC+; PURPLE = 12VDC+; GREY = 12VDC-; and GREEN = Equipment Ground.

13. Terminal Points:

    a. Terminal points of all terminal strips, relays and components shall be permanently identified. All terminal numbers, wire numbers and identifying nomenclature shall correspond to and be shown on electrical schematic diagrams.

14. Nameplates and Labels:

    a. All circuit breakers, control switches, indicator lights, relays, and other control devices shall be identified with permanently affixed

legend plates and lamicoid-type engraved nameplates where applicable. A black and red on white label stating "DANGER, HIGH VOLTAGE, 240 or 480 (use applicable) VOLTS" shall be affixed to the face of the inner door unit.

15. Documentation:

    a. The panel manufacturer shall furnish a list of components used in the construction of the panel. The list shall include renewal kits needed such as starter contacts, coils, bulbs, relays, alternators, switches and sockets. The list shall include manufacturer of the part, model number and part number.

16. Spare Parts:

    a. The manufacturer shall furnish the following spare parts for each panel supplied:

        (1) Five fuses of each size and type used.
        (2) Five bulbs of each size and type used.

    b. Spare parts shall be properly packaged and labeled for easy identification without opening the package and delivered at pump station start-up.

17. Electrical Schematic:

    a. An electrical schematic diagram shall be permanently affixed to the interior side of the exterior enclosure door with a copy supplied to the Owner personnel at start-up. The schematic diagram shall include the rated amperage and voltage for all components.

F. Functional Control Descriptions

1. Internal Recycle Pump:

    a. Each control panel shall allow for the manual and automatic control of the pump via a remote PLC and SCADA system. The automation is in the remote PLC.
    b. The HAND position shall start the pump if the local e-stop pushbuttons are not active.
    c. The OFF position will not allow the pump to run.

2. Grease Pump:

a. The grease pump shall run in unison with the recycling pump.

PART 3 EXECUTION

3.01 INSPECTION AND TESTING

A. The control panel manufacturer shall provide 2 days of start-up and testing services for the installed and completed installation. The services shall include all required adjustments of field and panel devices pertinent to the supplied control panel.

END OF SECTION